# SOIL SURVEY

# El Paso County Texas

## ELECTRONIC VERSION

This soil survey is an electronic version of the original printed copy, dated November 1971. It has been formatted for electronic delivery. (Technical content did not change from the original printed copy.) More data may be available within the Web Soil Survey. Identify an Area of Interest (AOI) and navigate through the Area of Interest Properties panel to learn what soil data is available for the AOI

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
TEXAS AGRICULTURAL EXPERIMENT STATION

Issued November 1971

**Major fieldwork for this soil survey was completed in the period 1960-66. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the El Paso-Hudspeth Soil Conservation District.**

**Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250**

# HOW TO USE THIS SOIL SURVEY

This soil survey contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in determining the suitability of tracts of land for farming, industry, and recreation.

### Locating Soils

All the soils of El Paso County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside, and a pointer shows where the symbol belongs.

### Finding and Using Information

The “Guide to Mapping Units (Removed)” can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green; those with a moderate limitation can be colored yellow; and those with a severe limitation can be colored red.

*Farmers and those who work with farmers* can learn about use and management of the soils from the soil descriptions and from the discussions of capability units and range sites.

*Ranchers and others* can find, under “Description of the Soils,” discussions of the soils according to their suitability for range, and also the names of many of the plants that grow on each soil. In addition, ranchers and others will find information about rangeland in the section “Range Sites and Condition Classes.”

*Community planners and others* can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section “Community Development.”

*Engineers and builders* can find, under “Engineering Uses of Soils,” tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

*Scientists and others* can read about how the soils were formed and how they are classified in the section “Formation and Classification of the Soils.”

*Newcomer in El Paso County* may be especially interested in the section “General Soil Map,” where broad patterns of soils are described. They also may be interested in the section “Additional Facts About the County.”

# Contents

Issued November 1971

# SOIL SURVEY OF EL PASO COUNTY, TEXAS

**BY HUBERT B. JACO**

**FIELD SURVEY BY HUBERT B. JACO AND LARRY M. LOCKWOOD, SOIL CONSERVATION SERVICE**

**UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION**

EL PASO COUNTY is in the far western tip of Texas (fig. 1). It is bordered by Hudspeth County on the east, the State of New Mexico on the west and north, and the State of Chihuahua, Mexico, on the south. The total area of the county is about 1,057 square miles or 676,683 acres. Prior to the Chamizal Treaty with Mexico in 1964, the total area was 677,120 acres. The county is shaped roughly like a right triangle; it extends about 55 miles from northwest to southeast and, at its widest, part, about 35 miles from west to east.

The average annual rainfall in the county is only 7.89 inches. Under irrigation, crops are grown on about 70,000 acres, mostly on the flood plain of the Rio Grande. Water for irrigation is obtained mainly from the Elephant Butte Dam-Rio Grande Project. The principal crop grown is cotton, both upland and Pima (also called Egyptian). Alfalfa is another important crop, and smaller acreages are used for small grains, grain sorghum, vegetable crops, sudangrass, pecans, and irrigated pasture.

The Far West Texas Research Station of Texas Agricultural and Mechanical University is in El Paso County.

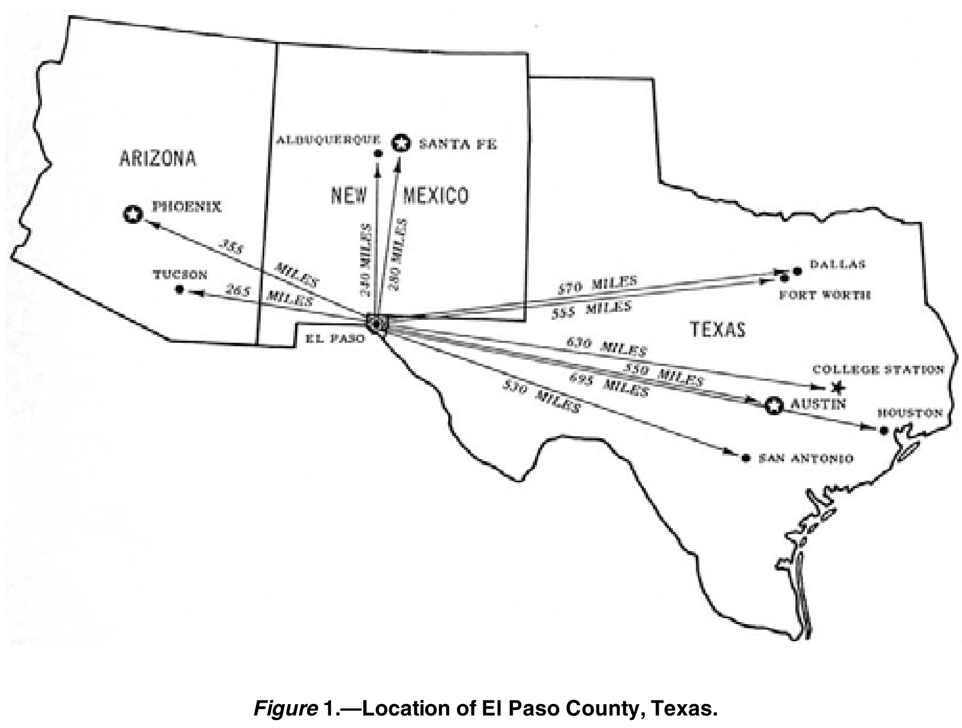


***Figure* 1.—Location of El Paso County, Texas.**

## How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in El Paso County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. As they traveled over the county, they observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not, been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among tile profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Gila and Hueco, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Glendale loam is one of several phases within the Glendale series.

After a guide for classifying and naming the soils has been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show roads, buildings, field borders, canals, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the soils of some other kind that have been within an area that, is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One kind of these mapping units is shown on the soil map of El Paso County; the association.

An association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but is shown as one unit because the time and effort needed for mapping them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. An association is named for the major soils in it; for example, Hueco-Wink association, hummocky.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Dune land is a land type in El Paso County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of rangeland, engineers, and homeowners.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with fanners, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

## General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in El Paso County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map also is useful as a general guide in managing a watershed or wildlife area or in planning engineering works, recreational facilities, and community developments. A general soil map, however, is not suitable for planning the management of a farm or field or in choosing the exact location for a building or other structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The eight soil associations in the county are discussed in the following pages.

### 1. Hueco-Wink Association

*Nearly level and gently sloping sails that have a fine sandy loam subsoil and are moderately deep over caliche; in the Hueco Bolson*

This association occupies a large area consisting mainly of nearly level and gently sloping soils in the Hueco Bolson (fig. 2). (Also see fig. 3.) It covers about 273,200 acres or 41 percent of the county.

About 42 percent of the total acreage is Hueco soils, 38 percent is Wink soils, and the rest is minor soils. The Hueco soils typically have a brown loamy fine sand surface layer, about 4 inches thick, that is mildly alkaline and noncalcareous. The subsoil is brown and yellowish-brown, calcareous fine sandy loam about 22 inches thick. At a depth of 26 inches, there is a layer of indurated caliche about 32 inches thick.

The Wink soils typically have a pale-brown surface layer about 6 inches thick and a light yellowish-brown subsoil about 18 inches thick. Both layers are calcareous fine sandy loam. Cemented caliche begins at a depth of about 24 inches.

Also in the association are Dune land; Turney, Berino, and Lozier soils; and Limestone rock land. Dune land occurs on the eastern side of the association and

consists of areas where shifting sand dunes are active. Turney and Berino soils are in the western part of the association.

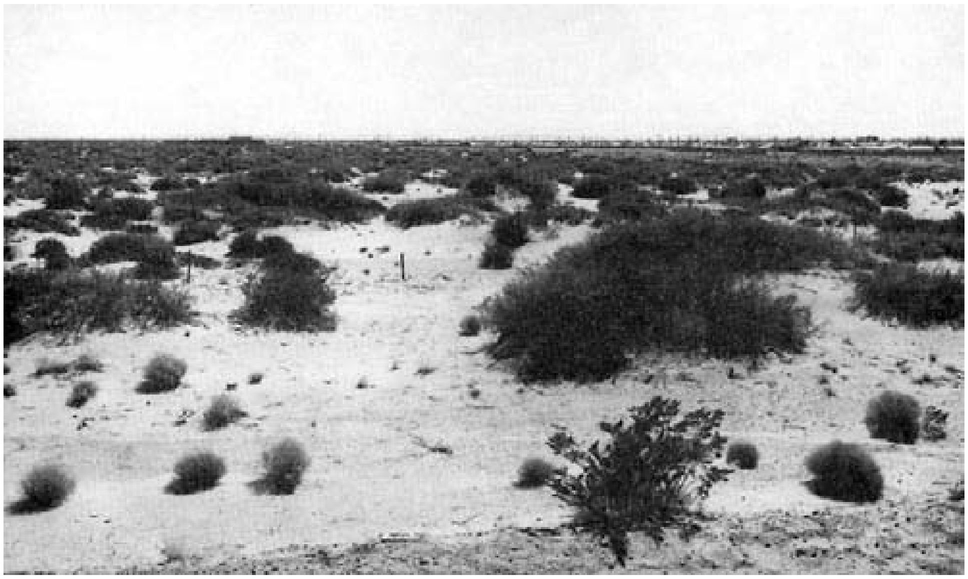

***Figure* 2.—Landscape in the Hueco-Wink soil association.**

About 12 percent of this association is used for housing, business, industry, and military purposes. The remaining acreage is idle or used as rangeland.

The chief kinds of wildlife are jackrabbit, cottontail rabbit, coyote, bobcat, mourning dove, blue quail, road runner, and various species of lizards and small rodents.

## 2. Bluepoint Association

*Deep, gently sloping to strongly sloping soils that have loamy sand underlying material; just above the Rio Grande flood plain*

This association consists mainly of gently sloping to strongly sloping soils that lie above the flood plain of the Rio Grande and below the escarpment of the Hueco Bolson (fig. 3). The association occupies about 101,300 acres, or 15 percent of the county (fig. 4).

The Bluepoint soils account for 98 percent of the association, and minor soils 2 percent. On about 89 percent of the total acreage, the Bluepoint soils have a loamy fine sand surface layer about 6 inches thick. This is underlain by very pale brown, moderately alkaline, loose material of sandy texture that is several feet thick. Bluepoint soils having a gravelly sand surface layer occur at higher elevations and make up about 9 percent of the association.

The Pajarito soils and Badlands occupy small areas. Pajarito soils are in low-lying places just above the Rio Grande flood plain. Badlands occur as outcrops or areas of exposed clay.

About 12 percent of the association is in the housing and industrial area of El Paso. Most of the remaining acreage is idle, but some is used as rangeland.

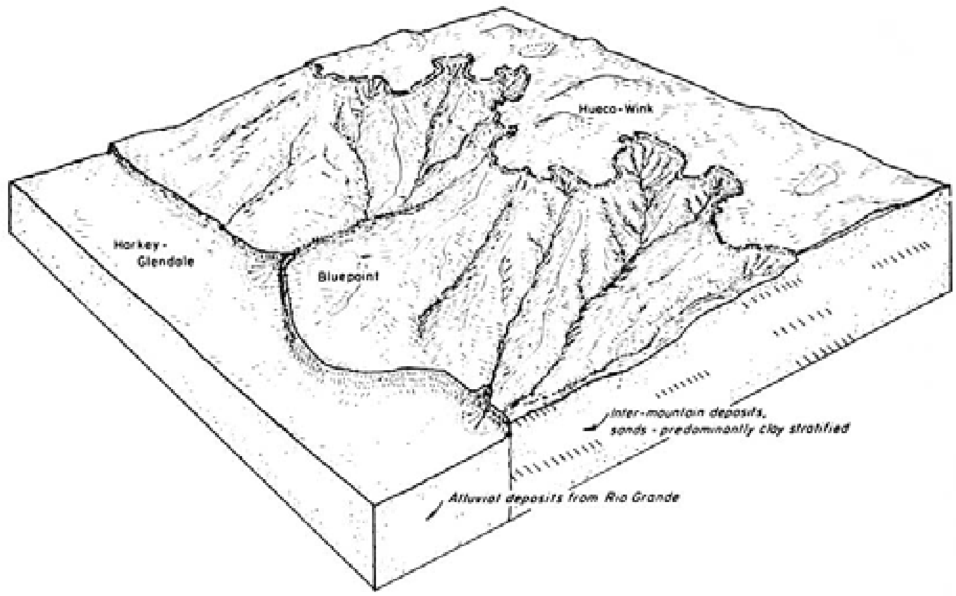


***Figure* 3.—Major soils in the Hueco-Wink, the Bluepoint, and the Harkey-Glendale soil associations and their relationship to the landscape.**

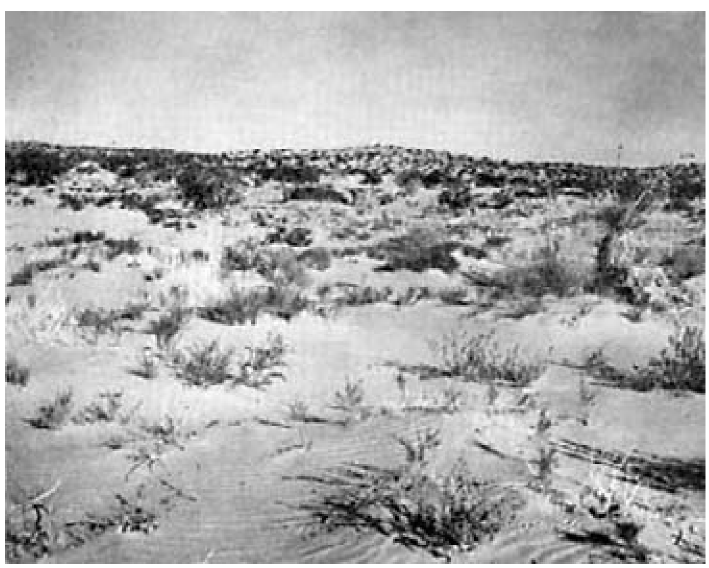

***Figure* 4.—Landscape in the Bluepoint soil association.**

Mourning dove is the principal game bird. Blue quail is less common, and Gambel quail occurs near the flood plain of the river. Other wildlife on the association are jackrabbit, cottontail rabbit, coyote, bobcat, road runner, eagle, raven, crow, and various species of lizards and small rodents (fig. 5).

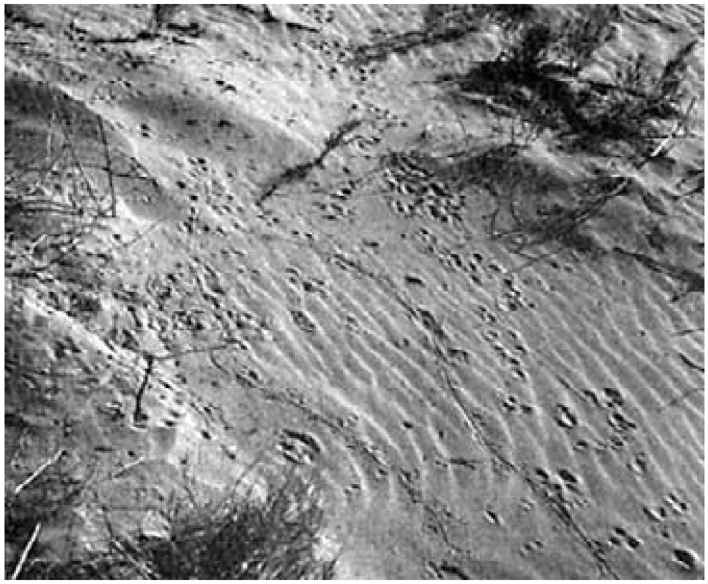

***Figure* 5.—Wildlife has been active in this area of Bluepoint soils.**

## 3. Harkey-Glendale Association

*Deep, nearly level soils that have loamy very fine sand to silty clay loam underlying material; on the Rio Grande flood plain*

This association is made up chiefly of deep, nearly level, calcareous soils on the Rio Grande flood plain. It occupies about 84,000 acres, or 13 percent of the county. (See fig. 3).

The Harkey soils account for about 37 percent of the total acreage, the Glendale soils about 16 percent, and minor soils about 47 percent. Harkey soils typically have a surface layer of pink, calcareous silty clay loam about 12 inches thick. The surface layer is underlain by stratified layers of silt loam, loamy very fine sand, very fine sandy loam, and silty clay loam. This underlying material has an average texture of loam.

In the Glendale soils the surface layer typically is brown, calcareous silty clay loam about 17 inches thick. Below this layer is silty clay loam that is about 18 inches thick and overlies fine sandy loam.

Also in the association are small areas of Saneli, Tigua, Gila, Anapra, Vinton, and Brazito soils. In addition, there are areas of made land, Gila soil material, in the city of El Paso and between the levee and the Rio Grande.

Most of this association is used as irrigated cropland. The principal crops are cotton and alfalfa, but small acreages are used for grain sorghum, small grain, bermudagrass pasture, and vegetable crops. About 15 percent of the association has been developed for residential, industrial, and commercial use.

Gambel quail (commonly called Bosque quail) and mourning dove occur throughout the association. Ducks and geese frequent areas along drainage ditches and irrigation canals, and a colony of whitewing dove occasionally comes into the area southeast of Fabens and west of the Hudspeth County line. Also in or along the drainage ditches are muskrat, channel catfish, largemouth bass, crappie, sunfish (perch), and various kinds of rough fish. Figure 6 shows a lake that has been constructed on this association for fishing, hunting, and boating.

***Figure 6.—A lake developed in an old river channel, Harkey-Glendale soil association, provides fishing, hunting, and boating.***

## 4. Delnorte-Canutio Association

*Nearly level to steep soils that are shallow or very shallow over caliche or that are deep and gravelly throughout; mainly on and near foot slopes of the Franklin Mountains*

In this association are nearly level to steep soils that occur mainly on foot slopes but also lie in or near arroyos and alluvial fans below the Franklin Mountains (fig. 7). (Also see fig.10) The association has a total area of about 63,700 acres, or 9 percent of the county.

***Figure* 7.—Landscape in the Delnorte-Canutio soil association.**

About 55 percent of the acreage is Delnorte soils, 18 percent is Canutio soils, and 27 percent is minor soils. The Delnorte soils, which occupy most of the higher and steeper areas, typically have a surface layer of pinkish-gray, calcareous very gravelly loams about 6 inches thick. This is underlain by strongly cemented or indurated caliche about 24 inches thick. Below the caliche is gravelly fine sand.

The Canutio soils lie in arroyos and on alluvial fiats between the hills. They are deep, nearly level to sloping soils that are calcareous very gravelly sandy loams throughout.

Minor soils are the Bluepoint, Agustin, and Pajarito; these occur in small areas at lower elevations.

About 50 percent of this association is within the city of El Paso and Fort Bliss. Roughly 1,000 acres, consisting of Pajarito soils, are used as irrigated cropland. The Delnorte soils outside the city and military area are idle or used for recreation.

Mourning dove and blue quail are the main game birds. Other kinds of wildlife are coyote, bobcat, eagle, jackrabbit, cottontail rabbit, raven, and crow.

## 5. Wink-Simona-Mimbres Association

*Nearly level to sloping soils that are moderately deep or shallow over hard caliche or that are deep and have a silt loam subsoil; mainly on alluvial fans and foot slopes of the Hueco Mountains*

This association consists of nearly level to sloping soils that lie below the Hueco Mountains and above the Hueco Mountains to the northeastern part of the county (fig. 8). It covers about 53,000 acres, or 8 percent of the county.

Of the total acreage, the Wink soils make up about 39 percent, the Simona soils 21 percent, the Mimbres soils 17 percent, and minor soils 23 percent.

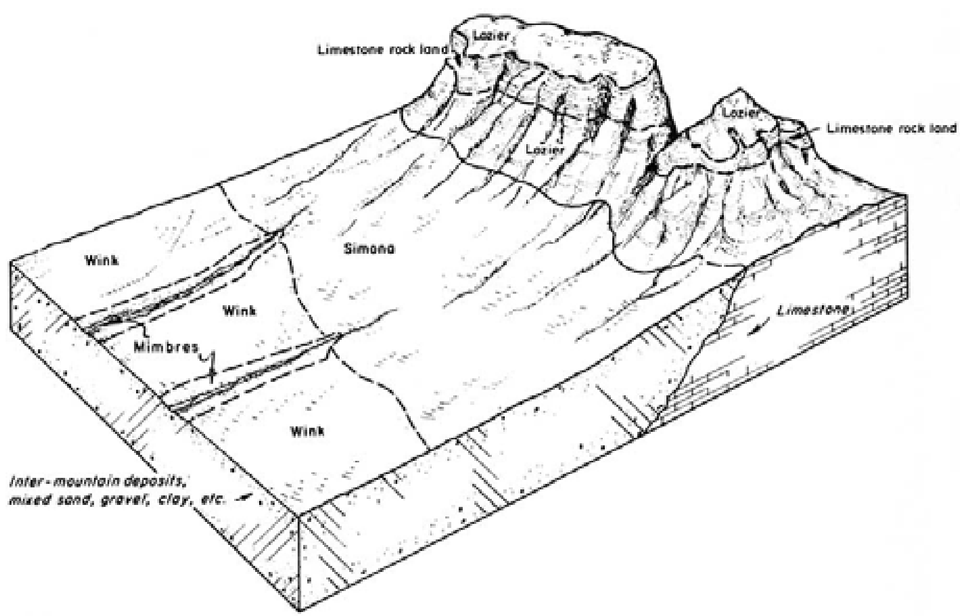


***Figure* 8.—Major soils in the Wink-Simona-Mimbres and the Limestone rock land-Lozier soil associations and their relationship to the landscape.**

The Wink soils are nearly level and gently sloping. They typically consist of pale-brown and light yellowish-brown, calcareous, moderately alkaline fine sandy loam that is 24 inches thick over cemented caliche.

The Simona soils occupy the higher and steeper part of the association, at or near the base of the Hueco Mountains. (See fig. 9.) These soils have a light pale-brown gravelly loam surface layer about 3 inches thick. Next is a pale-brown gravelly fine sandy loam subsoil about 13 inches thick. Both layers are calcareous and moderately alkaline. Indurated caliche begins at a depth of about 16 inches.

Mimbres soils are in playas and watercourses in the lowest part of the association. They are deep, calcareous soils that are light brownish-gray and brown silt loam to a depth of about 16 inches.

Other soils in the association are the Hueco, Pajarito, Agustin, and Lozier. The Hueco soils are at the western edge; the Pajarito and Agustin soils are in the eastern part; and the steep Lozier soils occur on isolated bills.

Most of the association is used as rangeland. Some of it is idle, and some is leased by the U.S. Army.

Mourning dove is the principal game bird. Blue quail also occurs but is less common. Mule, or black-tailed, deer live in the eastern part of the association near the Hueco Mountains. A few antelope are scattered throughout. Other wildlife includes jackrabbit, cottontail rabbit, coyote, bobcat, road runner, eagle, raven, and crow.

## 6. Limestone Rock Land-Lozier Association

*Steep and very steep, rocky areas and very shallow, stony soils; in the Hueco Mountains*

This association forms most of the Hueco Mountains in the northeastern part of the county. The elevation is about 4,000 feet at the base of the mountains and about 5,500 feet at the summit. The association covers roughly 41,800 acres, or 6 percent of the county.

Of the total acreage, Limestone rock land accounts for 63 percent. The rest consists of Lozier soils and small areas of Igneous rock land, Brewster soils, and Simona soils.

Limestone rock land is made up of vertical outcrops of limestone together with thin strata of sandstone in some places (fig. 9). The Lozier soils occupy lower slopes, small hills near the mountains, and rounded mountaintops. These very shallow soils have a surface layer of pinkish-gray, calcareous, moderately alkaline stony loam that is about 5 inches thick over limestone.

All of this association is used as rangeland or for wildlife or recreation. Hueco Tanks Park, a recreational and historic site, is on the association. Old Indian paintings and writings on the rocks can be observed in the park, and picnicking, rock climbing, and horseback riding can be enjoyed.

Mule deer and antelope are the principal large game mammals, and mourning dove is the most common game bird. Blue quail inhabits the association in some places. Among the other wildlife are jackrabbit, cottontail rabbit, bobcat, coyote, road runner, eagle, raven, and crow.

## 7. Turney-Berino Association

*Nearly level and gently sloping soils that have a clay loam subsoil and are moderately deep over soft caliche; in the Hueco Bolson*

This association consists of nearly level and gently sloping soils that lie in the Hueco Bolson, east of the Franklin Mountains in the northwestern part of the county. The association occupies about 30,700 acres, or 5 percent of the county.

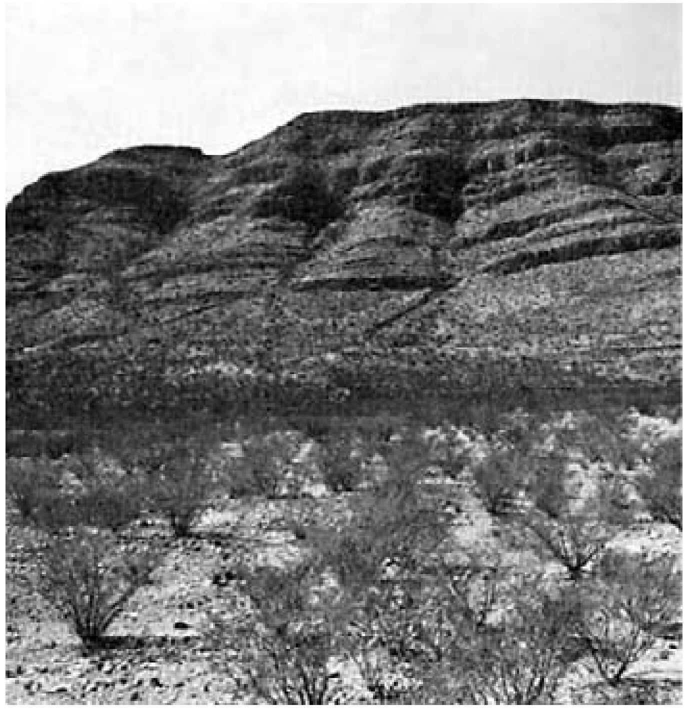

***Figure* 9.—In the background is Limestone rock land, a major component of soil association 6. In the foreground are Simona soils.**

About 68 percent of the total acreage is Turney soils, 18 percent is Berino soils, and 14 percent is minor soils. The Turney soils typically have a moderately alkaline, calcareous surface layer about 10 inches thick. It is light reddish-brown fine sandy loam to a depth of about 3 inches and is light-brown loam below. The subsoil is light-brown, calcareous clay loam. Depth to soft caliche is about 34 inches.

The nearly level Berino soils occupy the lowest part of the association. They are similar to the Turney soils in many respects, but their surface layer is noncalcareous and mildly alkaline, and their clay loam subsoil contains clay films on the soil particles.

Also in the association are Hueco soils, on the eastern edge and Agustin and Pajarito soils, at slightly higher elevations on the western edge.

The city of El Paso and military lands cover about 30 percent of the association. Except for 640 acres used for irrigated crops, the remaining 70 percent is range. Water for the city is supplied from many wells in this association.

Mourning dove and blue quail are the common upland game birds. Other wildlife includes jackrabbit, cottontail rabbit, coyote, bobcat, eagle, raven, and crow.

## 8. Igneous Rock Land-Limestone Rock Land Association

*Very steep areas of igneous and limestone rocks and stony soils; in the Franklin Mountains*

This association forms the Franklin Mountains in the western part of the county (fig. 10). The elevation is about 4,000 feet at the base and is 7,100 feet at the top of North Mount Franklin, the highest point. About 29,000 acres, or 4 percent of the county, is in this association.

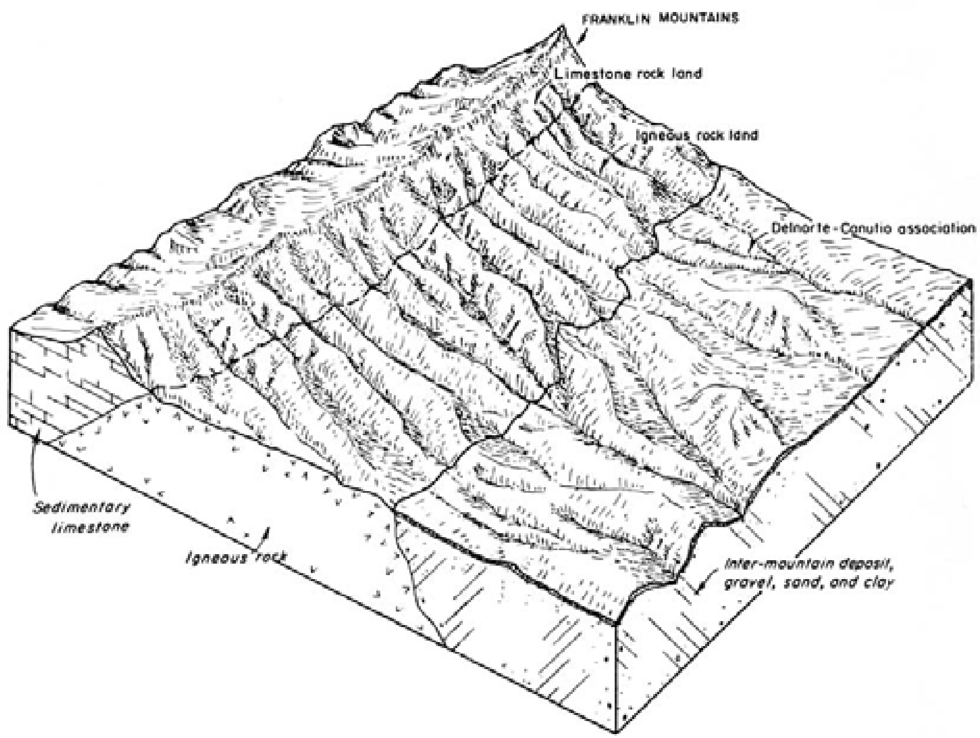


***Figure* 10.—Major land types and soils in the Igneous rock land-Limestone rock land and the Delnorte-Canutio soil associations and their relationship to the landscape.**

Roughly 52 percent of the total acreage is Igneous rock land and the adjacent Brewster soils, and 46 percent is Limestone rock land and the adjacent Lozier soils. Small areas of Delnorte and Canutio soils make up the remaining 2 percent.

Igneous rock land consists mostly of granite, monzanite, and rhyolite rocks that have nearly vertical slopes. The Brewster soils typically have a dark reddish-gray, noncalcareous stony loam surface layer that is 10 inches thick and is underlain by granite.

Limestone rock land is made up of almost vertical layers of limestone, together with some layers of sandstone (fig. 11). Typically, the Lozier soils have a surface layer of pinkish-gray, calcareous stony loam that is about 5 inches thick over limestone.

None of this association is suitable for cultivation. Among the suitable uses are hiking, picnicking, mountain climbing, and similar forms of outdoor recreation. A small area on the east slopes of North Mount Franklin is used by the U.S. Army as a rifle and artillery range.

Blue quail and morning dove are the chief game birds. Mule, or black-tailed, deer also inhabit the area. Other kinds of wildlife are coyote, bobcat, eagle, jackrabbit, cottontail rabbit, raven, and crow.

## Descriptions of the Soils

This section describes the soil series and mapping units of El Paso County. It also discusses the use and management of the soils for crops and range. The section is divided into two parts. In the first part are described the soils that were mapped within the high-intensity survey. The second part describes the napping units within the low-intensity survey.

***Figure* 11.—Landscape in the Igneous rock land-Limestone rock land association. The rock in this area is mainly limestone.**

The procedure in this section is first to describe the soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the series to which it belongs. The description of the soil series mentions features that apply to all the soils in the series. Differences among the soils of one series are pointed out in the description of the individual soils or are indicated in the soil name.

Each series contains a detailed description of a typical soil profile that scientists, engineers, and others can use in making highly technical interpretations. For the general reader, short descriptions of typical profiles are given in the descriptions of the mapping units.

As mentioned in the section “How This Survey Was Made,” not all mapping units are members of a soil series. Dune land and Igneous rock land, for example, do not belong to a soil series, but, nevertheless, are listed in alphabetic order along with the soil series.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description is the capability unit and range site in which the mapping unit has been placed. A discussion of capability units can be found in the section “Interpreting Soils by Capability Classification.” Range sites are discussed in the section “Range Sites and Condition Classes.”

The color of each soil horizon is described in words, such as grayish brown, but it can also be indicated by symbols for the hue, value, and chroma, such as 10YR 5/2. These symbols, called Munsell color notations, are explained in the “Soil Survey Manual” (*6*). They are used by soil scientists to evaluate the color of the soil precisely. Unless indicated otherwise, the colors given in the following descriptions are for the soils when dry.

Many terms used in the soil descriptions and other sections of the survey are defined in the Glossary.

***Figure* 13.—Barley residue left on the surface of Glendale silty clay for improving soil tilth.**

## Harkey series

The Harkey series consists of deep, pale-brown to pink soils that developed in friable, loamy sediments having a high content of lime. The sediments were recently deposited on the flood plain of the Rio Grande.

These soils are nearly level and have an almost uniform surface because all of their acreage in this county has been leveled for irrigation. In places the soils have been graded into benches, and here the difference in elevation varies from a few inches to about 2 feet. Flooding was once a hazard but now is controlled by dams and levees built along the river. Harkey soils are moderately well drained. Their internal drainage is medium, and their permeability is moderate or moderately slow. Fertility and the available moisture capacity are high.

In most areas the Harkey soils are used as irrigated cropland, but in places they are used for housing and commercial developments. Cotton and alfalfa are the principal crops grown. Also suitable are grain sorghum, corn, small grains, and vegetable crops. Pecan trees, as well as fruit trees suited to the climate, grow well on these soils.

Typical profile of Harkey silty clay loams, located in a cultivated field 50 feet northwest of Webb Road, 200 feet northeast of the junction of U.S. Highway No. 80 and Webb Road, 2.7 miles northwest of the junction of Farm Road 258 and U.S. Highway No. 80 in Fabens:

Ap— 0 to 12 inches, pink (7.5YR 7/4) silty clay loam, brown (7.5YR 5/4) moist; structureless; very hard when dry, friable when moist; plentiful roots; calcareous and moderately alkaline; abrupt, smooth boundary.

C1—12 to 19 inches, pinkish-gray (7.5YR 6/2) silt loam, brown (7.5YR 4/2) moist; generally structureless (massive) but includes discontinuous zones of weak to medium, coarse, subangular blocky structure; hard, friable; plentiful roots; calcareous and moderately alkaline; abrupt, wavy boundary.

## High-Intensity Survey

The high-intensity survey area is all of El Paso County that lies on the flood plain of the Rio Grande. The acreage and proportionate extent of the soils in this area are given in table 1.

A high-intensity survey is one that is made inn such detail that the mapping units are dominantly phases. These phases are narrowly defined on the basis of features that affect intensive use and management. The boundaries of mapping units are determined by examining the soils at close intervals. A high-intensity survey was made on all of the irrigated soils used for crops on the flood plain. The complexity of the soil pattern and the intensive use of the soils justified this kind of survey.

A detailed soil map of the high-intensity survey can be found at the back of this publication. The map was reproduced at a scale of 4 inches equal 1 mile (1:15,840).

### Anapra series

In the Anapra series are deep, brown soils that developed in stratified, calcareous material recently deposited on the flood plain of the Rio Grande. The material consists of silty sediments over sandy sediments.

Because all of their acreage in this county has been leveled for irrigation, these soils are nearly level and have an almost, uniform surface. In places they have been graded into benches where the difference in elevation from one bench to another varies from a few inches to about 2 feet. The Anapra soils formerly were subject to flooding by the river, but now they are protected by dams and levees. They are well drained and have rapid internal drainage. Their permeability is slow in the surface layer and the upper part of the underlying material, but it is rapid in the lower part. Fertility and the available moisture capacity are moderate. If the soils dry out after irrigation, a moderately hard crust forms on their surface.

The main crops grown are cotton and alfalfa. Also suitable are grain sorghum, small grains, and vegetable crops. Pecan trees, as well as fruit trees suited to the climate, grow well on these soils.

Typical profile of Anapra silty clay loam, located in a field 50 feet northeast of U.S. Highway No. 80, 0.8 mile northwest of the junction of that highway and Farm Road 258 at Fabens:

Ap—0 to 16 inches, brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; structureless (massive); hard, firm; calcareous and moderately alkaline; clear boundary.

C1—16 to 23 inches, brown (10YR 5/3) silty clay loam; brown (10YR 4/3) moist; weak subangular blocky structure; hard, firm; calcareous and moderately alkaline; abrupt, wavy boundary.

C2—23 to 60 inches +, pinkish-gray (7.5YR 7/2) fine sand, brown (10YR 5/2) moist; structureless; loose; few thin strata of loamy fine sand and fine sandy loam 1 to 3 inches thick; noncalcareous and moderately alkaline.

If the Anapra soils were not irrigated, they would usually be dry between the depths of 7 and 20 inches. The Ap horizon ranges from 10 to 18 inches in thickness and from clay loam to silty clay loam in texture. When this horizon is dry, it ranges from pinkish gray to pale brow in a hue of 7.5YR to 10YR, a value of 5 to 6, and a chroma of 2 to 4. The C1 horizon is silty clay loam to clay loam. It has a clay content of 18 to 35 percent, and less than 15 percent of the material is coarser than very fine sand. The C2 horizon is loamy fine sand to fine sand and generally is stratified. Below a depth of 40 inches, the sediments are stratified in layers ranging from fine sand to clay.

**Anapra silty clay loam** (An).—This nearly level soil occupies areas throughout the flood plain of the Rio Grande. The areas are generally 5 to 170 acres in size

and are irregular in shape. The soil makes up about 6 percent of the irrigated acreage in the county.

Typically, the surface layer of this soil is brown, calcareous silty clay loam about 16 inches thick. The next layer is brown, calcareous silty clay loam that extends to a depth of 23 inches. This is underlain by pinkish-gray fine sand that is stratified with thin layers of fine sandy loams and loamy fine sand.

Included with this soil in mapping are areas of Harkey silty clay loam and Glendale silty clay loam. These inclusions generally are less than 1 acre in size and lie in the same position in the landscape as Anapra silty clay loam.

This soil is used mostly as irrigated cropland. A few areas are used for residential and commercial developments. If the soil is properly irrigated and managed, it is suited to most of the common crops. Surface runoff is slow. The main concern of management is moderate crusting on the surface.

Cropping systems that include alfalfa, sudangrass, and barley are suitable for keeping the surface layer in good tilth and regularly supplying organic matter. Leaching the soil periodically controls salinity. The response to fertilization is good. Although the soil has been leveled for irrigation, additional leveling is needed in some places for better distribution of water (fig. 12). (Capability Unit IIs-3; range site not assigned)

**Brazito series**

The Brazito series consists of deep, pale-brown soils that lie on the flood plain of the Rio Grande. These soils developed in loose, stratified, sandy sediments recently deposited by the river.

Brazito soils have a nearly uniform surface, and their slopes are less than 1 percent. Internal drainage is rapid. The soils formerly were subject to flooding by the Rio Grande, but now they are protected by dams and levees. Although the soils take in water well, their moisture capacity is low. Fertility also is low.

***Figure* 12.—Irrigating Anapra silty clay loam. Siphon tubes deliver the water from a concrete-lined ditch.**

in size. The soil, which has all been leveled for irrigation, makes up about 22 percent of the irrigated acreage in the county.

The surface layer typically is pink, friable, calcareous silty clay loam about 12 inches thick. Below it, and extending to a depth of about 46 inches, are layers of silt loam, loamy very fine sand, and very fine sandy loam that have an average texture of loam. Underlying these layers are sediments that range from sand to clay.

Included in areas mapped as this soil are areas of Harkey loams, Saneli silty clay loam, Anapra silty clay loam, and Glendale silty clay. These inclusions are generally less than 1 acre in size and lie in the same position in the landscape as Harkey silty clay loams.

This soil is used mainly for irrigated crops, but in a few places it is used for residential and commercial developments. If it is properly irrigated and managed, it is well suited to most crops grown locally (fig. 14). Surface runoff is slow. Permeability is slow in the surface layer and moderate in the underlying material. Except in areas where a clay layer occurs, the underlying material is well drained. Fertility and the available moisture capacity are high. The main concern of management is slight crusting on the surface.

Cropping systems that include alfalfa, sudangrass, or barley can be used to maintain good tilth in the surface layer and to provide regular additions of organic matter. Although the soil has been leveled, additional leveling may be needed for better distribution of irrigation water. Periodic leaching helps to control salinity. The response to fertilization is good. (Capability unit I-1; range site not assigned)

***Figure* 14.—Cotton on Harkey silty clay loams. This crop followed alfalfa in the cropping sequence.**

### Made land, Gila soil material

Made land, Gila soil material (Mg) lies on the flood plain of the Rio Grande. It consists of soil material, chiefly from Gila soils, that is silty clay loam, fine sandy loam, and sand in texture. The deposits were recently laid down by the river, and since that time they have been moved about by man in constructing levees, relocating and straightening the river channel, and developing industrial, commercial, and residential areas. Also mapped as this land type were small areas of Anapra,

The Brazito soils are used mainly for irrigated crops, principally cotton and alfalfa. In addition, they are well suited to grain sorghum, small grains, and vegetable crops. A small acreage remains in brush and is not farmed. Some areas are used for housing and commercial developments.

A typical profile of Brazito loamy fine sand in a field 300 feet southwest of Farm Road 76, 4 miles northwest of Fabens:

Ap—0 to 10 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; structureless; loose; calcareous and moderately alkaline; clear boundary.

C—10 to 60 inches +, very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; structureless; loose; few roots; noncalcareous and mildly alkaline.

Unless irrigated, the Brazito soils are usually dry between the depths of 7 and 20 inches. The Ap horizon ranges from 5 to 16 inches in thickness and is loamy fine sand or fine sand in texture. When this horizon is dry, it has a hue of 7.5YR to 10YR, a value of 6 to 7, and a chroma 2 to 4. The C horizon, between the depths of 10 and 40 inches, is 4 to 10 percent fines. In some places this horizon is calcareous and moderately alkaline.

**Brazito loamy fine sand** (Br).—This nearly level soil is on the flood plain of the Rio Grande. It occupies areas that average 10 to 15 acres in size and are irregular in shape. The soil generally has a uniform surface because most of it has been leveled for irrigation, but farmers are gradually altering the texture fly covering the soil with 6 to 10 inches of finer textured material. Flooding, once a hazard, is now controlled by dams and levees constructed along the river. The soil makes up nearly 1 percent of the irrigated acreage in the county.

The surface layer of this soil typically is pale-brown, loose loamy fine sand about 10 inches thick. This layer is calcareous. Below it, and extending to a depth of more than 60 inches, is very pale brown, loose, noncalcareous fine sand in which the combined content of clay and silt is less than 4 percent.

Included with this soil in mapping are areas where the surface layer is fine sandy loam and areas of Vinton fine sandy loam. These inclusions are 1 acre or less in size and make up less than 15 percent of the total acreage. They occupy the same position in the landscape as Brazito loamy fine sand.

This soil is irrigated in most places. It is fairly well suited to cotton but is better suited to alfalfa. Some areas are used for housing and commercial developments, and a few areas are idle. In managing the soil, the main concerns are the severe hazard of soil blowing, very low available moisture capacity, low fertility level, and rapid depletion of organic matter.

Cropping systems that include alfalfa, barley, sudangrass, and other crops that produce a large amount of residue are suitable for controlling wind damage and providing a regular supply of organic matter. To check soil blowing, crop residues should be left on or near the surface. Because the rate of water intake is rapid, irrigation ditches should be lined to prevent excessive loss of water in the ditch. Salinity can be controlled by leaching. The response to fertilization is good. Additional leveling is needed in some places for better distribution of water. (Capability unit IVs-3; range site not assigned)

### Gila series

The Gila series consists of deep, light-brown soils that developed in stratified material recently deposited on the flood plain of the Rio Grande. The material is made up of friable, loamy sediments having a high content of lime.

Because all the acreage in this county has been leveled for irrigation, the Gila soils are nearly level and have an almost uniform surface. In many places they have been graded into benches where the difference in elevation from one bench to another varies from a few inches to about 2 feet. In earlier years these soils were subject to flooding, but now they are protected by dams and levees. They are well drained, have medium internal drainage, and are moderately permeable. Their fertility and available moisture rapacity are moderate.

Cotton and alfalfa are the principal crops grown, but grain sorghum, small grains, and vegetable crops also are suitable. Some areas of these soils have been developed for housing and commercial uses.

Typical profile of Gila fine sandy loam, located 100 feet northwest of a point on Herring Road that is 0.9 mile southwest of U.S. Highway No. 80 and Herring Road, which is 0.5 mile southeast of the junction of U.S. Highway No. 80 and Farm Road 1110 in Clint:

Ap—0 to 15 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 4/3) moist; structureless; hard when dry, friable when moist; common roots; calcareous; abrupt, smooth boundary.

C1—15 to 20 inches light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 4/3) moist; massive; fragments are hard when dry; friable when moist; plentiful roots; calcareous; abrupt, smooth boundary.

C2—0 to 27 inches, pinkish-gray (7.5YR 6/2) silt loam, brown (7.5YR 4/2) moist and brown (7.5YR 1/3) moist and crushed; weak subangular blocky structure, which is discontinuous; the rest of horizon is structureless; friable when moist; plentiful roots; calcareous; abrupt, smooth boundary.

C3—27 to 33 inches light reddish-brown (5YR 6/4) silty clay loam, reddish brown (5YR 4/4) moist; in thin layers with strong bedding planes; friable; slightly sticky; few roots; calcareous; abrupt, wavy boundary.

C4—33 to 42 inches, very pale brown (10YR 7/4) loamy fine sand, brown (10YR 5/3) moist; very weak bedding planes; very friable; calcareous; abrupt, wavy boundary.

C5—42 to 48 inches, alternate layers of silt loam, loamy fine sand and very fine sand; these layers vary from 1 to 3 centimeters in thickness; boundaries between layers are abrupt and parallel; calcareous; abrupt, wavy boundary.

C6—48 to 60 inches, very pale brown (10YR 7/3) very fine sand, pale brown (10YR 6/3) moist; structureless; very friable; calcareous.

C7—60 to 63 inches +, light-brown (7.5YR 6/4) silt loam, brown (7.5YR 4/4) moist; structureless; hard, friable; calcareous.

In places where the Gila soils are not irrigated, they are usually dry between the depths of 7 and 20 inches. The Ap horizon ranges from loam to fine sandy loam in texture. In color it ranges from pinkish gray to very pale brown; its hue is 7.5YR to 10YR, value is 6 to 7, and chroma is 2 to 4. The C1, C2, C3, and C4 horizons are pinkish gray to light reddish brown and very pale brown. These horizons consist of silt loam to loamy fine sand in thin strata. Their average clay content ranges from 5 to 18 percent. The amount of sand coarser than very fine is more than 15 percent. Cleavage between the bedding planes is weak to strong. Below a depth of 40 inches, the sediments are stratified and range from fine sand to silty clay.

**Gila fine sandy loam** (Ga).—This nearly level soil has the profile described as typical for the Gila series. The soil occurs throughout the flood plain of the Rio Grande, where it occupies areas that are irregular in shape and range from 5 to 250 acres in size. These areas formerly were subject to flooding by the river, but now they

are protected by dams and levees. The soil makes up about 3 percent of the irrigated acreage in the county. All of the soil has been leveled for irrigation.

Typically, the surface layer of this soil is light-brown, friable, calcareous fine sandy loams about 15 inches thick. Below the surface layer is stratified material that extends to a depth of more than 60 inches. This material consists of alternate layers of fine sandy loam, silt loams, silty clay loam, and loamy fine sand that have an average texture of fine sandy loam.

Areas mapped as this soil include areas of Vinton fine sandy loam, Harkey loam, and Gila loam. These inclusions generally are less than 1 acre in size and lie in the same position in the landscape as Gila fine sandy loam.

This soil is used mostly as irrigated cropland. A few areas are used for residential and commercial developments. If the soil is properly irrigated and managed; it is well suited to most crops grown locally. Surface runoff is slow, but soil blowing is a hazard in fields that are left unprotected. Fertility and the available moisture capacity are moderate.

Cropping systems that include alfalfa, sudangrass, barley, and other close-growing crops are suitable for controlling erosion. Because the soil is moderately permeable, irrigation ditches should be lined to conserve water. Additional leveling is commonly needed for better distribution of water. Leaching the soil periodically helps in controlling salinity. The response to fertilization is good. (Capability unit IIe–3; range site not assigned)

**Gila loam** (Gc).—This nearly level soil occupies areas throughout the flood plain of the Rio Grande. The areas range from 5 to 250 acres in size, are irregular in shape, and have all been leveled for irrigation. In places tile soil has been graded into benches, and here the difference in elevation from one bench to the next varies from a few inches to about 2 feet. Dams and levees prevent flooding by the river. The soil makes up about 4 percent of the irrigated acreage in the county.

The surface layer of this soil typically is light-brown, friable, calcareous loam about 17 inches thick. It is underlain by layers of loamy fine sand, loam, fine sandy loam, and fine sand that extend to a depth of 40 inches.

Included with this soil in mapping are areas of Vinton fine sandy loams, Harkey loams, and Gila fine sandy loam. These included areas generally are less than 1 acre in size and occur in the same position in the landscape as Gila loam.

Most of this soil is used as irrigated cropland, though a few areas are used for housing and other community developments. Crops normally grow well if the soil is properly irrigated and managed. Surface runoff is slow. Fertility and the available moisture capacity are moderate. The main concerns of management are irrigating efficiently and maintaining or improving soil tilth.

Cropping systems that include alfalfa, sudangrass, and barley are suitable for keeping the surface layer in good tilth and regularly supplying organic matter. In areas where the irrigation water is of poor quality, leaching the soil periodically helps to control salinity. Although the soil has been leveled, additional leveling is needed in some places for improving the efficiency of irrigation. Lining the ditches aids in controlling excessive loss of water. The soil responds well to fertilization. (Capability unit I-2; range site not assigned)

### Glendale series

In the Glendale series are deep, brown soils that developed in stratified, loamy, friable sediments having a high content of lime. These sediments were recently deposited on the flood plain of the Rio Grande.

All the acreage of Glendale soils in this county has been leveled for irrigation, and consequently the soils are nearly level and have an almost uniform surface. In many places they have been graded into benches where the difference in elevation from one bench to

another varies from a few inches to about 2 feet. These soils formerly were subject to flooding by the river, but now they are protected by dams and levees. They are well drained or moderately well drained, have medium internal drainage, and are moderately to very slowly permeable. Fertility and the available moisture capacity are high.

The Glendale soils are used mostly for irrigated crops, principally cotton and alfalfa. They also are suited to grain sorghum, corn, small grains, vegetable crops, and pecan trees. In addition, fruit trees suited to the climate grow well. Some areas of Glendale soils have been developed for residential and commercial uses.

Typical profile of Glendale silty clay loam, located in a cultivated field, 70 feet southeast of Farm Road 1110, 1.2 miles southwest of the junction of that road and U.S. Highway No. 80 in Clint:

Ap—0 to 17 inches, brown (7.5YR 5/2) silty clay loam, brown (7.5YR 4/2) moist; weak subangular blocky structure; hard and firm; calcareous and moderately alkaline; clear boundary.

C1—17 to 35 inches, pinkish-gray (7.5YR 7/2) silty clay loam, brown (7.5YR 5/2) moist; weak subangular structure; hard and firm; evident bedding planes; calcareous and moderately alkaline; abrupt boundary.

C2—35 to 60 inches +, pinkish-gray (7.5YR 7/2) fine sandy loam, pinkish gray (7.5YR 0/2) moist; structureless (massive) or weak granular structure; soft and friable; calcareous and moderately alkaline.

Unless irrigated, the Glendale soils are usually dry between the depths of 7 and 20 inches. The Ap horizon ranges from 10 to 19 inches in thickness and from silty clay to loam in texture. When this horizon is dry, its hue ranges from 5YR to 10YR, its value is 5 to 7, and its chroma is 2 to 4. In the C1 horizon, the clay content ranges from 20 to 35 percent and the sand content coarser than very fine sand is less than 15 percent. Texture of the C2 horizon is clay to fine sand.

**Glendale loam** (Gd).—This soil is nearly level and occupies areas throughout the Rio Grande flood plain. The areas range from 5 to 15 acres in size and are irregular in shape. They are now protected by dams and levees, though in former years they were subject to flooding by the river. All the acreage of this soil has been leveled for irrigation. In places it has been graded into benches where the difference in elevation from one bench to the next varies from a few inches to about 2 feet. This soil makes up about 1.3 percent of the irrigated acreage in the county.

Typically, the surface layer is pale-brown, friable, calcareous loam about 19 inches thick. Below this layer, and extending to a depth of about 40 inches, is silty clay loam that contains a few thin strata of silt loam.

Included in areas mapped as this soil are areas where the surface layer is fine sandy loam. Also included are areas of Harkey loam, Saneli silty clay loam, and Gila loam. These inclusions generally are less than 1 acre in size and occupy the same position in the landscape as Glendale loam.

This soil is used chiefly as irrigated cropland, though in a few places it is used for residential and commercial developments. If the soil is properly irrigated and managed, it is suited to most of the common crops. Surface runoff is slow. Permeability is moderate in the surface layer but is slow in the material below it. Generally, the underlying material is well drained. The main concerns of management are maintaining good tilth and providing regular additions of organic matter.

Cropping systems that include alfalfa, sudangrass, and barley are suitable for maintaining good tilth and supplying organic matter. Leaching the soil periodically helps to control salinity. The response to fertilization is good. Although all the acreage has been leveled for irrigation, additional leveling may be needed for better distribution of water. (Capability unit I-2; range site not assigned)

**Glendale silty clay loam** (Ge).—A profile of this soil is described as typical for the Glendale series. The soil is nearly level and occupies areas throughout the Rio Grande flood plain. These areas are irregular in shape; they range from 5 to 100 acres in size. All the acreage has been leveled for irrigation. The soil makes up 5.4 percent of the irrigated acreage in the county.

Typically, the surface layer of this soil is brown, friable, calcareous silty clay loam about 17 inches thick. The next layer is silty clay loam that contains a few thin lenses of silt loam. This is underlain by sediments consisting of layers that range from clay to sand.

Areas mapped as this soil include areas of Saneli silty clay, Tigua silty clay, Glendale silty clay, Glendale loam, Harkey loam, Gila loam, and Saneli silty clay loam. These inclusions are generally less than 1 acre in size and lie in the same position in the landscape as Glendale silty clay loam.

This soil is used mostly as irrigated cropland. A few areas are used for residential and commercial developments. If the soil is well managed and irrigated, it produces a good growth of most crops common in the county. Surface runoff is slow. Permeability is slow in the surface layer and below it. Fertility and the available moisture capacity are high. Generally, the underlying material is well drained. In managing the soil, the main concerns are surface crusting and slight susceptibility to salinity. As the soil dries out after irrigation, a moderately hard crust forms on the surface.

Cotton and alfalfa are the main crops grown, but grain sorghum, small grains, and vegetable crops also are suitable. In addition, pecan trees, irrigated pasture grasses, and fruit trees suited to the climate grow well on this soil.

Cropping systems that include alfalfa, sudangrass, and burley are suitable for keeping the surface layer in good tilth and for supplying regular additions of organic matter. Leaching the soil periodically helps to control salinity. For better distribution of irrigation water, additional leveling is needed in some places. This soil responds well to fertilization. (Capability unit I-1; range site not assigned)

**Glendale silty clay** (Gs).—Areas of this nearly level soil occur throughout the flood plain of the Rio Grande. They range from 5 to 100 acres in size and are irregular in shape. All the acreage has been leveled for irrigation. The soil makes up about 9 percent of the irrigated acreage in the county.

Typically, the surface layer is reddish-brown, very hard, calcareous silty clay about 18 inches thick. It overlies material that is mainly silty clay loam but includes a few thin strata of silt loam. The underlying sediments consist of strata of clay to fine sand.

Included with this soil in mapping are areas of Glendale silty clay loam, Harkey silty clay loam, and Gila loams. These inclusions generally are less than 1 acre in size and occupy the same position in the landscape as Glendale silty clay.

This soil is used chiefly for irrigated crops. It is well suited to these crops if it is properly irrigated and managed. Surface runoff is slow. Permeability is very slow in the surface layer and is slow in the material below it. The available moisture capacity and fertility are high. The main concerns of management are hard crusting on the surface, very slow permeability in the surface layer, and moderate susceptibility to salinity.

Alfalfa, sudangrass, and barley should be included in the cropping system, for they help to maintain or improve tilth in the surface layer (fig. 13). Periodic leaching aids in controlling salinity. The response to fertilization is good. Additional leveling is commonly needed to obtain better distribution of irrigation water. (Capability unit IIs–2; range site not assigned)

C2—19 to 30 inches, pink (7.5YR 7/4) loamy very fine sand, light brown (7.5YR 6/4) moist; structureless; loose; weak bedding planes; few roots; calcareous; abrupt, wavy boundary.
C3—30 to 36 inches, pinkish-gray (7.5YR 6/2) silt loam, brown (7.5YR 4/2) moist; evident bedding planes; hard, friable; calcareous and moderately alkaline; abrupt, wavy boundary.
C4—36 to 46 inches, pale-brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; structureless; slightly hard, friable; calcareous and moderately alkaline; abrupt, wavy boundary.
C5—46 to 50 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; structureless; hard, friable; calcareous and moderately alkaline; abrupt, wavy boundary.
C6—50 to 60 inches +, very pale brown (10YR 7/3) very fine sand, loamy fine sand, and silt loam in stratified layers, pale brown (10YR 6/3) moist; evident bedding planes; slightly hard, friable; calcareous and moderately alkaline.

Unless the Harkey soils are irrigated, they are usually dry between the depths of 7 and 20 inches. The Ap horizon ranges from 10 to 18 inches in thickness and from silty clay loam to loams in texture. When this horizon is dry, it has a hue of 7.5YR to 10YR, a value of 5 to 7, and a chroma of 2 to 4. In the C1, C2, C3, and C4 horizons, the clay content ranges from 5 to 18 percent and the amount of soil material coarser than very fine sand is less than 13 percent. Stratification ranges from faint to distinct. Strata below a depth of 40 inches range from fine sand to clay in texture.

**Harkey loam** (Ha).—This nearly level soil occupies areas throughout the Rio Grande flood plain. The areas are irregular in shape and range from 10 to 100 acres in size. All of the acreage has been leveled for irrigation. The soil makes up 16 percent of the irrigated acreage in the county.

Typically, this soil has a surface layer of pale-brown, friable, calcareous loams about 17 inches thick. Next are layers of stratified soil material that extend to a depth of about 40 inches. The layers consist of loamy very fine sand, fine sandy loam, loams, and very fine sandy loams that have all average texture of loam. Beginning at a depth of 40 inches are sediments ranging from sand to clay in texture.

Included with this soil in mapping are areas of Harkey silty clay loams. Saneli silty clay loam, Gila loams, Vinton loams, and soils that have a fine sandy loam surface layer. These inclusions generally are less than 1 acre in size and occur in the sauce position in the landscape as Harkey loams.

This soil is used mainly as irrigated cropland, though a few areas are used for housing and commercial developments. Most crops grow well if the soil is properly managed and irrigated. Permeability is moderate in the surface layer and in the underlying material. This material is well drained, except in places where it includes a clay layer. Fertility and the available moisture capacity are high. Maintaining good tilth and regularly supplying organic matter are the main concerns of management.

Cropping systems that include alfalfa, sudangrass, or barley are suitable for keeping the soil in good tilth and for providing additions of organic matter. Lining irrigation ditches reduces seepage, and additional leveling is needed in some places for better distribution of water. To help control salinity, the soil should be leached periodically. The response to fertilization is good. (Capability unit I-2; range site not assigned)

**Harkey silty clay loam** (Hk).—This soil has the profile described as typical for the Harkey series. The soil is nearly level and occupies irregularly shaped areas throughout the flood plain of the Rio Grande. The areas range from 10 to 200 acres

Brazito, Glendale, Saneli, Tigua, and Vinton soils. The land type makes up about 1 percent of the county.

Among the areas in which this land occurs is one that extends along the rectified channel of the Rio Grande. To maintain a permanent boundary between the United States and Mexico, the river was straightened; and a manmade channel was constructed. On both sides of the river, 200 to 400 feet back from the main channel, levees were constructed so that the farmland and populated areas would he protected from flooding. Southeast of the city of El Paso, the land that lies between the main channel and the levee is U.S. Government property and is under control of the International Boundary and Water Commission (IBWC). This area extends continuously along the length of the river. It is used mostly for recreation, but a small acreage is leased for grazing.

Northward from El Paso City to the New Mexico line, and beyond, the Rio Grande is entirely in the United States and the land between the river and the levee on each side is controlled by the IBWC.

Made land, Gila soil material, also occurs in the industrial, commercial, and residential parts of El Paso that occupy the Rio Grande flood plain.

Outside the levee are other areas of this land type that have never been cultivated and cannot now be irrigated because water is unavailable. These areas are irregular in shape and are mostly less than 10 acres in size. They lie 3 to 6 feet lower than the surrounding soils, and in places they are cut by old narrow river channels that are 10 to 12 feet lower. The areas have a rough and uneven surface. They may have a water table at a depth of 2 to 6 feet. The vegetation consists of saltcedar, screwbean mesquite, and other salt-tolerant plants. These small areas are generally idle, though they provide cover and some food for dove and quail. Some areas are used as a source of sandy material that is placed on, or mixed into, the surface layer of clayey soils in irrigated fields nearby. (Capability unit VIc-1; range site not assigned)

**Saneli series**

In the Saneli series are deep, brown to pinkish-gray soils that developed in stratified, very firm material recently deposited on the Rio Grande flood plain. The material consists of silty clay over sandy sediments.

Because all of their acreage in this county has been leveled for irrigation, these soils are nearly level and have an almost uniform surface. In places they have been graded into benches where the difference in elevation from one bench to another varies from a few inches to about 2 feet. In former years the Saneli soils were subject to flooding by the river, but now they are protected by dams and levees. The soils are moderately well drained and have very slow surface runoff. Although water enters these soils rapidly when they are dry and cracked, it enters very slowly when they are wet and the cracks are sealed. Internal drainage is slow. Fertility and the available moisture capacity are high.

The Saneli soils are used mainly as irrigated cropland, though in some places they are used for housing and commercial developments. Cotton and alfalfa are the principal crops, but grain sorghum, corn, small grains, and vegetable crops also are suitable. Pecan trees, as well as fruit trees suited to the climate, can be grown.

Typical profile of Saneli silty clay, located in a cultivated field 50 feet west of Prado drive, 0.75 mile southwest of U.S. Highway No. 80, northwest of Ysleta High School:

Ap—0 to 12 inches, pinkish-gray (7.5YR 6/2) silty clay, brown (7.5YR 5/2) moist; weak subangular blocky structure; mostly fragments of pods; very hard, very firm; few cracks that are 2 centimeters wide and extend to lower boundary; plentiful roots; moderately alkaline and calcareous; abrupt, smooth boundary.

C1—12 to 32 inches, pinkish-gray (5YR 6/2) clay, reddish gray (5YR 5/2) moist; medium and coarse angular fragments and a few distinct parallelepipeds; very hard, very firm; plentiful roots; few whitish films; and threads of salt; moderately alkaline and calcareous; abrupt, wavy boundary.

C2—32 to 42 inches, very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; structureless; weak bedding phases; loose, very friable, calcareous; abrupt boundary.

C—42 to 60 inches +, alternate strata of pale-brown fine sand and brown silt loam and loam; structureless; evident bedding planes; moderately alkaline and calcareous.

If the Saneli soils were not irrigated, they would usually be dry between the depths of 7 and 20 inches. The thickness of the soil material over sand ranges from 21 to 34 inches. When dry, these soils have cracks that are more than 1 centimeter wide and 12 inches long and that extend 20 inches or more below the surface. The clay is dominantly montmorillinite, and the sand is of mixed mineralogy. The content of organic matter decreases irregularly with depth to 50 inches below the surface. The Ap horizon ranges from silty clay loams to silty clay in texture. In many fields this horizon is more loamy than the original A horizon, because man has covered the surface with loamy soil material. When the Ap horizon is dry, it has a hue of 7.5YR to 10YR, a value of 5 to 6, and a chroma of 2 to 4. When moist, it has a value of more than 3. The texture of the C1 horizon is clay or silty clay, and that of the C2 horizon is fine sand to loamy fine sand.

**Saneli silty clay loam** (Sa).—This nearly level soil occupies areas throughout the flood plain of the Rio Grande. The areas are irregular in shape and range from 10 to 100 acres in size. All of the acreage has been leveled. The soil makes up 9 percent of the irrigated cropland in the county.

Typically, the surface layer of this soil is light-brown, friable, calcareous silty clay loam about 18 inches thick. Next is a layer of reddish-brown, very hard, calcareous clay that extends to a depth of about 34 inches. The clay is underlain by loamy fine sand extending to a depth of more than 40 inches.

Included with this soil in mapping are areas of Harkey silty clay loam, Glendale silty clay loam, Harkey loam, Gila loam, and soils having a surface layer of loam underlain by clay over sand. These inclusions generally are less than 1 acre in size and occupy the same position in the landscape as Saneli silty clay loam.

This soil is used chiefly for irrigated crops, though a few areas are used for residential and commercial developments. Surface runoff is slow. Permeability is slow in the surface layer and is very slow in the material below it. The surface layer forms a crust as it dries, and the underlying clay is poorly suited to the growth of plant roots. This soil is susceptible to salinity. Fertility and the available moisture capacity are high.

Cotton and alfalfa are the principal crops grown on this soil. Small acreages are used for barley, grain sorghum, and vegetable crops. The soil is well suited to irrigated pasture plants, such as Coastal bermudagrass. Controlling salinity and keeping the soil in good tilth are the main concerns of management.

Cropping systems that include alfalfa or other deep-rooted crops are suitable for improving structure in the clay that underlies the surface layer. Barley, sudangrass, or other crops having fibrous roots help to improve tilth in the surface layer. Salinity can be controlled by leaching the root zone periodically. The soil is better suited to crops that are tolerant of salts than to other crops. Although all the acreage has been leveled for irrigation, additional leveling may be needed for good distribution of water. The soil responds well to fertilization. (Capability unit IIIs-4; range site not assigned)

**Saneli silty clay** (SC).—This nearly level soil has the profile described as typical for the series. The soil, which occurs throughout the Rio Grande flood plain, occupies areas of irregular shape that range from 5 to 50 acres in size. All the acreage has been leveled for irrigation. The soil accounts for 3.3 percent of the irrigated acreage in the county.

This soil typically has a surface layer of pinkish-gray, very hard, calcareous silty clay about 12 inches thick. The next layer is pinkish-gray clay that extends to a depth of about 12 inches. It overlies about 10 inches of fine sand, which in turn is underlain by layers of fine sand, silt loam, and loams.

Areas mapped as this soil include areas of Saneli silty clay loam, Glendale silty clay loam, Harkey silty clay loam, and Anapra silty clay loam. These inclusions generally are less than 1 acre in size and lie in the same position in the landscape as Saneli silty clay.

This soil is used mainly as irrigated cropland, though some areas are used for housing, business, and similar purposes. Surface runoff is slow. Permeability is very slow in the surface layer and the underlying clay layer, but it is rapid below the clay. A hard crust forms on the surface, and this crust makes the emergence of seedlings difficult. The soil is moderately to severely susceptible to salinity. Fertility and the available moisture capacity are high.

The principal crops grown are cotton and alfalfa. Small acreages are used for barley, grain sorghum, sudangrass, and vegetable crops, and the soil is well suited to irrigated pasture plants. Controlling salinity and maintaining good tilth are the main concerns of management. Care in irrigating is essential so that crops are not damaged by excess water.

Cropping systems that include barley, sudangrass, grain sorghum, or other plants having fibrous roots are suitable for improving tilth in the surface layer (fig. 15). Alfalfa or other deep-rooted legumes or grasses are useful for increasing aeration and permeability in the clay below the surface layer. Periodic leaching of the root zone aids in the control of salinity. Additional leveling is commonly needed for better distribution of irrigation water. This soil responds well to fertilization. (Capability unit IIIs-1; range site not assigned)

### Tigua series

In the Tigua series are deep, pinkish-gray soils that developed in sediments recently deposited on the flood plain of the Rio Grande. These sediments consist of very hard, very firm clay to silty clay that has a high content of lime.

All of the acreage has been leveled for irrigation, and consequently these soils are nearly level and have an almost uniform surface. Commonly, they have been graded into benches where the difference in elevation from one bench to the next varies from a few inches to about 2 feet. In former years the Tigua soils were subject to flooding by the river, but now they are protected by dams and levees. They are somewhat poorly drained and have very slow internal drainage and permeability. Surface runoff is very slow to ponded. The available moisture capacity and fertility are high.

The Tigua soils are used chiefly as irrigated cropland, though some areas have been developed for residential and commercial uses. Cotton and alfalfa are the principal crops, but grain sorghum, corn, small grains, and vegetable crops also are suitable.

Typical profile of Tigua silty clay, located in a cultivated field 65 feet southeast of Denton Road, 0.6 mile southwest of U.S. Highway No. 80, 1.1 miles southeast of the junction of U.S. Highway No. 80 and Farm Road 1110 in Clint:

Ap—0 to 10 inches, pinkish-gray (7.5YR 6/2) silty clay, brown (7.5YR 5/2) moist; weak subangular blocky structure to massive (structureless); very hard, very firm; calcareous and moderately alkaline; clear, smooth boundary.

***Figure* 15.—Residue from grain sorghum left on the surface of Saneli silty clay.**

C1—10 to 50 inches, pinkish-gray (5YR 6/2) clay, reddish gray (5YR 5/2) moist; massive with a few distinct parallelepipeds; extremely hard; extremely firm; contains a few very thin lenses of very fine sandy loam; few salt deposits; calcareous and moderately alkaline; abrupt, wavy boundary.

C2—50 to 60 inches +, light-gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak granular structure; soft, friable; calcareous and moderately alkaline.

The thickness of the soil over sandy or loamy material ranges from 40 to 70 inches. Where the Tigua soils are not irrigated, they are usually dry between the depths of 7 and 20 inches. When these soils are dry, they shrink and form cracks that are 2 to 10 centimeters wide, are 12 inches or more long, and extend to a depth of 20 inches. The clay fraction is dominantly montmorillonite. The soils range from saline free to moderately saline. The texture of the A horizon is clay or silty clay. The dry colors of the A and C1 horizons range from pinkish gray to light brown in hues of 7.5YR and 5YR. In the C1 horizon the clay content is 60 to 70 percent. The lower part of the C1 horizon contains lenses of loamy sediments. The C2 horizon ranges from sand to clay that is stratified with sandy or loamy sediments.

**Tigua silty clay** (Tg).—Areas of this nearly level soil occur throughout the Rio Grande flood plain. They range from 5 to 100 acres in size and are irregular in shape. All the acreage has been leveled for irrigation. The soil makes up 8.5 percent of the irrigated cropland in the county.

Typically, the surface layer is pinkish-gray, very hard, calcareous silty clay about 10 inches thick. This is underlain by clay that extends to a depth of about 50 inches. Below the clay is very fine sandy loam that is stratified with layers of finer textured or coarser textured material.

Included in areas mapped as this soil are areas of Harkey silty clay loam, Glendale silty clay loam, and Anapra silty clay loam. These inclusions generally are less than 1 acre in size and occupy the same position in the landscape as Tigua silty clay.

This soil is used chiefly for irrigated crops, to which it is well suited if it is properly irrigated and managed. Some areas have been developed for residential and commercial uses. Surface runoff is slow on this soil. Permeability is very slow in the clayey material but is moderate in the underlying sandy or loamy material. A hard crust that forms on the surface makes the emergence of seedlings difficult. The soil is moderately to severely susceptible to salinity. Its fertility and available moisture capacity are high.

Cotton and alfalfa are the principal crops grown. Small acreages are used for barley, grain sorghum, sudangrass, and vegetable crops. Irrigated pasture plants grow well. Salt-tolerant crops are more suitable than others.

Controlling salinity and improving tilth are the main concerns of management. Leaching the soil periodically helps to control salinity (fig. 16). Cropping systems that include barley or sudangrass are suitable for improving tilth in the surface layer, and alfalfa or other deep-rooted legumes or grasses help to increase permeability in the subsoil. For better distribution of irrigation water, additional leveling is needed in some places. The response to fertilization is good. (Capability unit IIIs-1; range site not assigned)

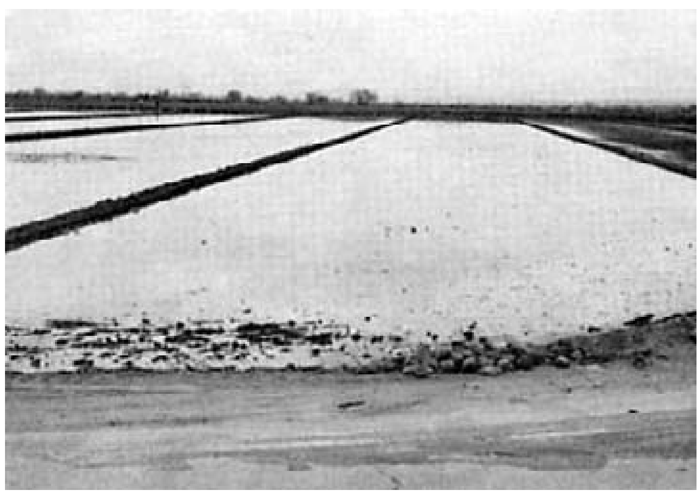

***Figure* 16.—A heavy application of irrigation water used for removing excess salts from the root zone of Tigua silty clay before the next crop is planted.**

## Vinton series

The Vinton series consists of deep, pale-brown soils on the Rio Grande flood plain. These soils developed in friable, stratified fine sandy loam and sandy sediments that were recently deposited by the river and have a high content of lime.

Because all of their acreage in this county has been leveled for irrigation, these soils are nearly level and have an almost uniform surface. In places they have been graded into many benches, and here the elevation from one bench to another varies from a few inches to about 2 feet. At one time the Vinton soils were subject to flooding by the Rio Grande, but now they are protected by dams and levees. They are well drained, have very slow surface runoff, and have rapid internal drainage. Their fertility and available moisture capacity are moderately low.

Irrigated cropland is the main use for the Vinton soils, but some areas are used for residential and commercial developments. The principal crops grown are cotton and alfalfa, grain sorghum, small grains, and vegetable crops also are suitable. Pecan trees and irrigated pasture grasses can be grown on these soils and so can fruit trees that are suited to the climate.

Typical profile of Vinton fine sandy loam, located in a cultivated field 50 feet northwest of a field road, 200 feet northeast of Farm Road 258, 1.55 miles southeast of the junction of Farm Road 258 and Farm Road 1110 in San Elizario:

Ap—0 to 12 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; structureless; hard, very friable; plentiful roots; calcareous and moderately alkaline; abrupt, smooth boundary.

C—12 to 60 inches +, very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; thin strata of very fine sandy loam, 1 centimeter to 3 centimeters thick, and thin strata of fine sand; loose; few roots; calcareous and moderately alkaline.

Unless they are irrigated, the Vinton soils are usually dry between the depths of 7 and 20 inches. The Ap horizon ranges from 10 to 16 inches in thickness and from fine sandy loam to loam in texture. When this horizon is dry, it has a hue of 7.5YR to 10YR, a value of 5 to 7, and a chroma of 2 to 4. The C horizon is loamy fine sand that is stratified with fine sand, fine sandy loam, and very fine sandy loam. The average texture of the C horizon is loamy fine sand. Below a depth of 40 inches, there are stratified sediments ranging from sand to clay.

**Vinton fine sandy loam** (Vn).–This nearly level soil occurs throughout the flood plain of the Rio Grande, where it occupies irregularly shaped areas that range from 5 to 50 acres in size. All of the acreage has been leveled. The soil makes up about 4 percent of the irrigated acreage in the county.

The surface layer typically is pale-brown, very friable, calcareous fine sandy loams about 12 inches thick. Below the surface layer is loamy fine sand that extends to a depth of 60 inches or more and is stratified with thin layers of very fine sandy loam and fine sand.

Areas snapped as this soil include areas of Harkey loams, Gila loams, and Brazito loamy fine sand. These inclusions generally are less than 1 acre in size and lie in the same position in the landscape as Vinton fine sandy loam.

This soil is used mostly as irrigated cropland. A few areas are used for housing and commercial developments. If the soil is properly irrigated and managed, it is well suited to most crops grown locally. Surface runoff is slow. Permeability is moderate in the surface layer and rapid below it. The available moisture capacity and fertility are moderately low.

Cotton and alfalfa are the principal crops grown. Small acreages are used for barley, grain sorghum, and vegetable crops. Also, the soil is suited to bermudagrass and other plants grown for irrigated pasture. In managing this soil, the main concerns are the moderately low fertility and available moisture capacity and the risk of soil blowing.

Cropping systems that include alfalfa, barley, or sudangrass help to protect the soil from wind damage. Loss of irrigation water can be reduced by lining the ditches (fig. 17). Additional leveling is needed in some places for better distribution of water. Leaching periodically aids in the control of salinity. The response to fertilization is good. (Capability unit IIIs–5; range site not assigned)

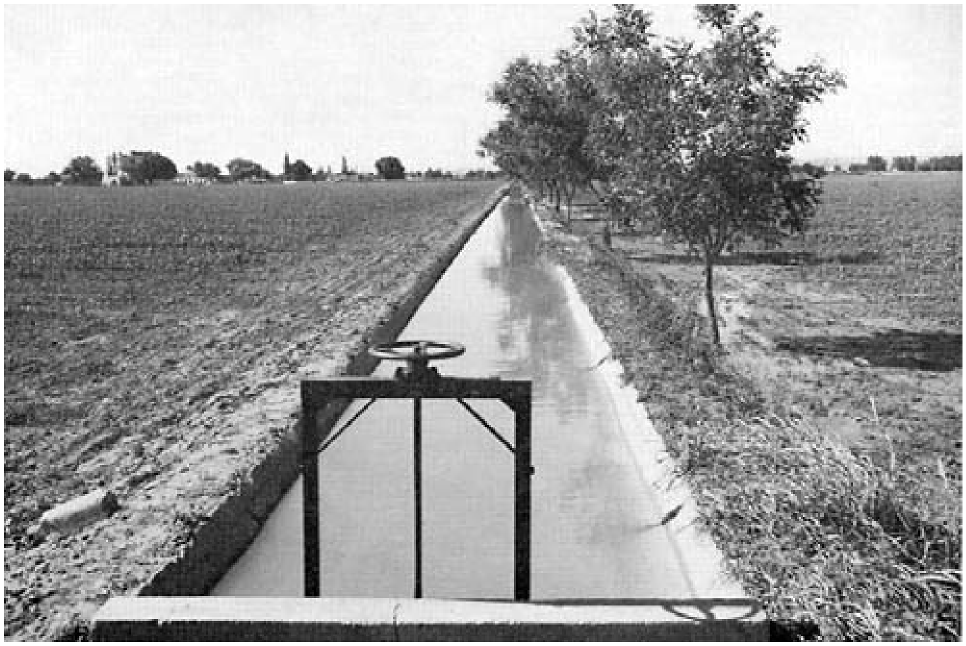

***Figure* 17.—An irrigation ditch, constructed on Vinton fine sandy loam, has been lined with concrete.**

## Low-Intensity Survey

The low-intensity survey area is the part of El Paso County that is not on the flood plain of the Rio Grande. The acreage and proportionate extent of the mapping units in this survey area are given in table 2.

A low-intensity survey is one in which the mapping units are dominantly associations of broadly defined phases. The boundaries of mapping units are determined by examining the soils at distant intervals. The composition of the low-intensity units is more variable than that of the high-intensity units but has been controlled well enough for the expected use of the soils, such as range.

A detailed soil map of the low-intensity survey can be found at the back of this publication. The map was reproduced at a scale of 2 inches equal 1 mile (1:31,680).

### Agustin series

The Agustin series consists of deep, pale-brown, gravelly soils that lie at the base of limestone and igneous mountains and on alluvial fans, generally near gravelly arroyo. These soils receive runoff from higher areas.

The surface of these soils is plane or convex. The convex areas are nearest to the mountains. Agustin soils are well drained, have medium internal drainage, and are moderately permeable. They absorb moisture well, except where the grass cover is sparse, and they have moderate to low fertility and available moisture capacity.

These soils are used mostly for range, but a small acreage is used for irrigated crops, housing, and commercial developments, or is idle. The crops grown are cotton, grain sorghum, and alfalfa.

Typical profile of an Agustin gravelly loam, located in a pasture 100 feet east of fence on War Road, 4.4 miles northwest of U.S. Highway No. 54 in El Paso at Northgate Shopping Center:

A1—0 to 12 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; weak granular structure; slightly hard, friable; 20 to 30 percent, by volume, pebbles that are $\frac{1}{8}$ to 3 inches across and coated with caliche; a few stones; calcareous and moderately alkaline; gradual boundary.

B2—12 to 30 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; weak granular structure; slightly hard, friable; few lime threads and films; about 25 percent, by volume, limestone pebbles that are coated with caliche; calcareous and moderately alkaline; abrupt, irregular boundary.

C—30 to 60 inches +, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; weak granular structure; slightly hard, friable; 50 percent, by volume, caliche-coated limestone pebbles; a few large stones; calcareous and moderately alkaline.

Unless irrigated, the Agustin soils are usually dry. The A horizon ranges from 4 to 29 inches in thickness and from gravelly loam to fine sandy loam in texture. The gravel content in the A horizon ranges from 10 to 30 percent, by volume. In the B2 horizon the gravel content is 15 to 35 percent, by volume, and in the C horizon it is 0 to 50 percent.

**Agustin association, undulating** (AGB).—This mapping unit consists of gently sloping and undulating soils that occupy broad alluvial fans above the Rio Grande flood plain and at the base of the mountains. The areas are irregular in shape and range from 100 to 2,000 acres in size. Gently sloping areas have a plane surface, and undulating areas near the mountains have a convex surface.

Typically, the surface layer of the Agustin soils is pale-brown, friable, calcareous gravelly loam about 12 inches thick. The subsoil is pale-brown, friable, calcareous gravelly loam about 18 inches thick (fig. 18). Pebbles of limestone that are coated with caliche make up about 25 percent of the subsoil, by volume.

Included in areas mapped as this association are areas of Simona, Pajarito, Delnorte, and Wink soils. Also, there are inclusions of soils in which the content of pebbles and cobblestones in the subsoil is more than 35 percent, by volume. These included soils are in irregularly shaped areas of 10 to 100 acres that occur in the same position in the landscape as the Agustin soils.

About 50 percent of the potential plant community on these soils is mid-grass decreasers, such as side-oats grama, Arizona cottontop, plains bristlegrass, bush muhly, black grama, sand dropseed, and perennial three-awns. The principal increasers are fluffgrass, hairy tridens, and short tridens. Woody increasers are range ratany, dalea, and skeletonleaf goldeneye. Common invaders are creosotebush, lechuguilla, ocotillo, mesquite, broom snakeweed, cactus, and annual grasses and forbs. If the range is in excellent condition, the average annual yield of air-dry herbage on these soils varies from 250 to 375 pounds per acre, depending on variations in rainfall. (Capability unit IVs-4, irrigated; VIIs-1, dryland; Gravelly range site of the Desert Shrub vegetative zone)

***Figure* 18.—Profile of an Agustin gravelly loam.**

## Badlands

Badlands (BA) occur at and below the caliche-capped escarpments that separate the Hueco Bolson from the watershed of the Rio Grande. This land type is in discontinuous areas that lie parallel to the river and extend from the southeastern side of the city of El Paso south-eastward to the Hudspeth County line. The areas are irregularly shaped and 50 to 500 acres in size. Slopes are convex and range from 5 to 40 percent. Except for a few small plants of creosotebush, the land surface is bare.

Badlands consist mainly of heavy, plastic, reddish-gray clay that is stratified with layers of pink calcareous very fine sandy loam. Gullies are common in this soil material. The layers of clay are generally 4 to 9 feet thick, and the layers of very fine sandy loam are 2 to 6 feet thick. The clay is almost impervious; it is seldom wet to a depth of more than 3 or 4 inches.

Also trapped as Badlands are the caliche ridgetops and areas where gravelly sand overlies the reddish-gray clay.

This land is not suitable as cropland, and it has no value as rangeland. (Capability unit VIIIs-1; range site not assigned)

## Berino series

The Berino series consists of brown, moderately alkaline soils that are moderately deep to weakly cemented caliche. These soils developed in alluvial sediments on the Hueco Bolson northeast of El Paso. They occupy the lower parts of the bolson.

The surface of these soils is concave in some places and plane in others. Slopes are less than 1 percent in most areas, though they range to 2 percent. The soils are

well drained, but in some places they lie next to playas and may be ponded for a few hours. Internal drainage is medium, and permeability is moderate. These soils are occasionally flooded by runoff from the mountains. They absorb water well and have high available moisture capacity and fertility.

The Berino soils are used mainly for range and community developments. One small area is used as irrigated cropland. If water is available for irrigation, these soils are well suited to many crops grown locally.

In El Paso County the Berino soils were mapped only in an association with the Turney soils. This association is described under the heading “Turney series.”

Typical profile of a Berino fine sandy loam in a pasture, 38 feet east of the fence, 495 feet east of Faint Road 2529 (McCombs St.), 4.5 miles north of U.S. Highway No. 54 (Dyer St.) in northeast El Paso:

A11—0 to 8 inches, brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; massive; apparently winnowed by wind; soft, very friable; few fine roots; noncalcareous and mildly alkaline; abrupt boundary.

A12—8 to 13 inches, brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; massive; porous; slightly hard, friable; contains few pebbles ⅛ to ¼ inch across; root and termite channels; noncalcareous and mildly alkaline; clear, wavy boundary.

B21t—13 to 20 inches, yellowish-red (5YR 4/6) clay loam, same color moist; weak subangular blocky structure; slightly hard when dry, friable when moist; very thin, patchy clay skins; root and termite channels; few fine pebbles; lower part contains a few, fine, soft concretions of calcium carbonate, but matrix is noncalcareous and mildly alkaline; clear, wavy boundary.

B22t—20 to 37 inches, brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; brown (7.5YR 4/2) stains and soil material that have filled the termite or earthworm channels; moderate, fine, blocky structure; very hard when dry, very firm when moist; continuous, very thin clay skins; few soft concretions of calcium carbonate; calcareous, moderately alkaline; clear, wavy boundary.

C1ca—37 to 82 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 4/4) moist; weak granular structure; slightly hard when dry, friable when moist; contains 30 percent, by volume, visible carbonates that are weakly cemented; few fine roots; calcareous and moderately alkaline; clear boundary.

C2—82 to 100 inches +, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; structureless; soft when dry; very friable when moist; contains 3 to 5 percent, by volume, pebbles ⅛ to ¾ inch across; calcareous and moderately alkaline.

These soils are usually dry between the depths of 7 and 20 inches. The combined thickness of the horizons above the C1a horizon ranges from 20 to 40 inches. The A horizon ranges from 7 to 18 inches in thickness and from fine sandy loam to loam in texture. When this horizon is dry, it has a hue of 7.5YR, a value of 5 to 6, and a chroma of 2 to 6. The A horizon is mildly to moderately alkaline and, in places, is calcareous. The B21t horizon ranges from 5 to 10 inches in thickness and is sandy clay loam or clay loam in texture. In places the B21t horizon is lacking. The B22t horizon is 10 to 20 inches thick and has a clay content of 20 to 30 percent. The C1a horizon ranges from 30 to 50 inches in thickness. Cementation in this horizon is weak to strong. Texture of the C2 horizon is loamy fine sand to loam.

**Bluepoint series**

Soils of the Bluepoint series are deep, very pale brown, sandy, and moderately alkaline. They developed over outwash sediments, some of which have been altered by wind.

The surface of these soils is convex in some places and concave in others. Slopes range from 1 to 8 percent. The soils are well drained and have rapid internal drainage, slow surface runoff, and rapid permeability. Their available moisture capacity is low. Soil blowing is a severe hazard in unprotected areas.

Most of the acreage is used for housing, business, or recreation or is idle. Only a little of it is used for range.

Typical profile of a Bluepoint loamy fine sand, located in a pasture 400 feet southwest of Interstate Highway 10, 5 miles southeast of its junction with Farm Road 659:

A1—0 to 6 inches, very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; structureless; loose when dry or moist; noncalcareous and alkaline; abrupt boundary.

AC—6 to 12 inches, very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; structureless; loose when dry or moist; calcareous and alkaline; clear boundary.

C—12 to 60 inches +, very pale brown (10YR 7/4) loamy fine sand, yellowish brown (10YR 5/4) moist; structureless; loose when dry or moist; calcareous and moderately alkaline.

The profile is usually dry between the depths of 7 and 20 inches. When the A, AC, and C horizons are dry, they are 7.5YR to 10YR in hue, 6 to 7 in value, and 2 to 4 in chroma. The A horizon ranges from 3 to 7 inches in thickness and is fine sand or loamy fine sand. Except for thin calcareous crusts, the A horizon generally is noncalcareous. The AC horizon is fine sand or loamy fine sand and is either calcareous or noncalcareous. The C horizon is fine sand or loamy fine sand. In places this horizon contains a few fine concretions of calcium carbonate that make up less than 1 percent of the horizon, by volume. The total content of fines in the C horizon is 10 to 25 percent. Rounded pebbles of igneous rock, on the surface and in the profile, make up 0 to 30 percent of the soil mass. Some of these pebbles are coated with calcareous material.

**Bluepoint association, rolling** (BPC).—This mapping unit lies just above the flood plain of the Rio Grande. The largest area is long and narrow; it extends from the city of El Paso southeastward to the Hudspeth County line. Smaller areas in the western part of the county are 50 to 200 acres in size and irregular in shape.

Bluepoint loamy fine sand, the major soil, makes up about 75 percent of the total acreage. The remaining 25 percent consists of Bluepoint gravelly fine sand, Pajarito soils, and Badlands.

Bluepoint loamy fine sand typically is made up of very pale brown, loose, alkaline loamy fine sand to a depth of at least 60 inches.

Most of the acreage in this mapping unit is idle. Small areas are used for residential and commercial developments.

The native grasses are chiefly mesa dropseed, sand dropseed, spike dropseed, and giant dropseed. Because of overgrazing in the past, however, the original plant cover has been replaced mainly by woody plants, such as creosotebush, mesquite, yucca, and four-wing saltbush. Between these woody plants the soil is bare, except for annual grasses and forbs that come in after summer rains. Scattered colonies of mesa dropseed and sand dropseed remain throughout the association. The average annual yield of air-dry herbage on these soils is about 100 pounds per acres. (Capability unit VIIe-1; Sandyland range site of the Desert Shrub vegetative zone)

**Bluepoint gravelly association, rolling** (BUC).—This mapping unit consists of rolling soils on dissected beds of out wash sediments below the Hueco Bolson. It lies in discontinuous areas that extend from the city of El Paso southeastward to the

Hudspeth County line. The areas range from 50 to several hundred acres in size and are irregular in shape.

Bluepoint gravelly sand is the major soil; it covers about 65 percent of the association. About 20 percent is Bluepoint loamy fine sand, and 15 percent is Badlands.

Bluepoint gravelly sand occurs on the tops and sides of rolling hills. It has a convex surface and slopes of 2 to 8 percent. Bluepoint loamy fine sand lies on the lower side slopes and in the drainageways between the hills. Its surface is concave, and its slopes are 1 to about 5 percent. Badlands are at the higher elevations between Bluepoint gravelly sand and the exposed caliche of the Hueco Bolson. The surface of Badlands is convex, and slopes are as much as 45 percent.

Typically, Bluepoint gravelly sand has a surface layer that is about 13 inches thick and is light brown, loose, calcareous, and moderately alkaline. This layer is underlain by light-gray, loose, calcareous, mildly alkaline loamy sand several feet thick.

Most of this association is idle. Some areas are used as a source of sand and gravel, and a small acreage is used as rangeland.

The potential plant community consists of decreaser grasses, such as chino grama, black grama, and perennial three-awns. The principal increaser plants are ocotillo, lechuguilla, catclaw acacia, and red grama. Creosotebush is a common invader. (Capability unit VIIe-1; Gravelly Outwash range site of the Desert Shrub vegetative zone)

**Brewster series**

The Brewster series consists of very shallow, stony soils on igneous mountains. These soils generally developed over granite rock and are friable, noncalcareous, and mildly alkaline.

Brewster soils have a convex surface, and in most places their slopes are more than 20 percent. Drainage is good. The soils absorb water well, but they are so shallow that the total amount of moisture held available for plants is very small.

These soils are used for range or recreation or are idle. They are not suitable for cultivation.

In El Paso County the Brewster soils were mapped only in an association with Igneous rock land, a miscellaneous land type. This association is described under the heading “Igneous rock land.”

Typical profile of a Brewster stony loam, located 790 feet east of the end of the parking area in Tom May’s Memorial Park, 5.6 miles east of Canutillo on Tom Mays Park Road:

A1—0 to 10 inches, dark reddish-gray (5YR 4/2) stony loam, dark reddish brown (5YR 3/2) moist; moderate, fine, subangular blocky structure; slightly hard, friable; 60 to 70 percent, by volume, angular pebbles, cobblestones, stones, and boulders of granite; noncalcareous, mildly alkaline; abrupt, irregular boundary.

R—10 inches +, granite rock.

The Brewster soils are dry more than half the time, but they are not continuously dry in all parts for as long as 60 consecutive days during the summer months. The depth to the R layer ranges from 4 to 12 inches. The A horizon ranges from stony clay loam to stony loam and has a clay content of 22 to 30 percent. This horizon is 5YR to 7.5YR in hue, 3 to 4 in value, and 2 to 3 in chroma. It has an organic-matter content of more than 1 percent. The R layer is some kind of igneous rock.

### Canutio series

The Canutio series is made up of deep, pale-brown, very gravelly soils in and near the active parts of arroyos and alluvial fans. These soils developed in gravelly, loamy sediments that have been recently deposited and are high in content of lime (fig. 19).

***Figure* 19.—Profile of a Canutio soil. This is the bank of an arroyo.**

The Canutio soils generally have a concave surface, but their microrelief includes small islands and stream channels. Slopes range from 1 to about 8 percent. The soils are excessively drained, have rapid surface runoff, and are moderately rapid in permeability. They are flooded during heavy rains; the floodwater commonly forms new channels and fills the old ones with gravelly sediments.

Canutio soils are used for range or are idle. They support a sparse stand of range plants.

In El Paso County the Canutio soils were mapped only in associations with the Delnorte soils. These associations are described under the heading “Delnorte series.”

Typical profile of a Canutio very gravelly sandy loam, located on a pipeline road 0.7 mile north of Tom Mays Park Road, 2.4 miles east of U.S. Highway No. 80 at Canutio; this is about 10 miles north of El Paso via U.S. Highway No. 80:

A1—0 to 11 inches, pale-brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; structureless; slightly hard, very friable; common roots; about 30 percent, by volume, rounded pebbles of igneous rock and limestone, and a few cobblestones and stones; about 60 percent of surface is covered with coarse fragments ¼ inch to 8 inches across; moderately alkaline and calcareous; gradual, wavy boundary.

C—11 to 45 inches +, pale-brown (10YR 6/3) very gravelly sandy loam; structureless; loose, very friable; few roots in upper part; about 60

percent, by volume, pebbles of igneous rock and limestone, as well as cobblestones and stones; coarse fragments are mostly rounded; moderately alkaline and calcareous.

These soils are usually dry between the depths of 7 and 20 inches. The combined thickness of the A1 and C horizons ranges from 35 to more than 60 inches. The A1 horizon ranges from very gravelly sandy loam to gravelly loam. When the A1 and C horizons are dry, they have hues of 10YR and 7.5YR, values of 5.5 to 7, and a chroma of 2 to 3. The texture of the C horizon ranges from very gravelly sandy loam to very gravelly loam. Coarse fragments of igneous rock acid limestone make up 25 to 50 percent of the A1 horizon, by volume, and 35 to 75 percent of the C horizon. These fragments range from ¼ inch to 15 inches in diameter. Coarse fragments in the C horizon are caliche coated, and some of the ones on the surface are caliche coated on the lower side but not on the upper.

**Delnorte series**

In the Delnorte series are pinkish-gray, very gravelly soils that are shallow or very shallow to hard caliche. These soils occur on foot slopes and outwash plains of igneous and limestone mountains. They developed over outwash material consisting of sand and gravel.

The surface is plane in lower areas where the soils are gently sloping, and it is convex in higher areas where the soils are steeper. Slopes range from 1 to 8 percent at the lower elevations and from 5 to 30 percent at the higher elevations near the mountains. The Delnorte soils have rapid surface runoff and are excessively drained. Their internal drainage is restricted by a layer of indurated caliche near the surface. The available moisture capacity is low.

Typical profile of a Delnorte very gravelly loam, located in a pasture 100 feet south of Tom Mays Park Road, 3.5 miles east of U.S. Highway No. 80 in Canutillo, ½ mile south of junction of that highway and Farm Road 259, approximately 10 miles north of El Paso via U.S. Highway No. 80:

A1—0 to 6 inches, pinkish-gray (7.5YR 6/2) very gravelly loam, brown (7.5YR 4/4) moist; weak granular structure; slightly hard, friable; 60 percent, by volume, angular and subrounded caliche-coated pebbles of igneous rock, mostly less than 2 inches across; few rounded cobblestones; calcareous and moderately alkaline; abrupt, wavy boundary.

C1ca—6 to 10 inches, white, fractured, strongly cemented caliche and a small amount of soil material from A1 horizon; plentiful fine roots at lower boundary and on the top of the next horizon; abrupt, wavy boundary.

C2cam—10 to 30 inches, whitish, indurated caliche in layers 5 to 7 inches thick; few embedded pebbles; abrupt, wavy boundary.

C3—30 to 60 inches +, very pale brown (10YR 7/3) gravelly fine sand, pale brown (10YR 6/3) moist; structureless; loose; 80 percent, by volume, caliche-coated subrounded pebbles of limestone and igneous rock, mostly less than 2 inches across.

The profile is usually dry. The combined thickness of the horizons above the C2cam horizon ranges from 8 to 20 inches. The average organic-matter content to a depth of 15 inches or to the depth of the C2cam horizon, whichever is less, is more than 0.7 percent. In texture the A1 horizon ranges from very gravelly loam or stony loam to very gravelly fine sandy loam or stony fine sandy loam. The content of clay in the A1 horizon is 10 to 25 percent, and that of sand is 30 to 60 percent. When the A1 horizon is dry, it ranges from pinkish gray to very pale brown and has a hue of 7.5YR to 10YR, a value of 6 to 7, and a chroma of 2 to 4. When moist, the A1 horizon is 1 and 2 units less in value than

when it is dry. Coarse fragments, mainly pebbles or cobblestones, make up 55 to 70 percent of the solum, by volume. Most of the fragments are granite or other igneous rocks.

**Delnorte-Canutio association, undulating (DCB).—**This mapping unit consists of undulating soils on uplands in the western and northwestern parts of the county (fig. 20). It lies in oblong areas that extend in a north-south direction, parallel to the Franklin Mountains and the Rio Grande. These areas range from 200 to 1,000 acres in size. The Delnorte soils are in areas of 150 to 750 acres and make up nearly 75 percent of the total acreage. They are in the higher parts of the association. The Canutio soils occupy areas of 50 to 250 acres and make up nearly 25 percent of the association. They are in frequently flooded arroyos 100 to 500 feet wide, and they also are on alluvial fans adjacent to the arroyos. Delnorte and Canutio soils all have a plane surface and slopes of 1 to 8 percent.

***Figure* 20.—Landscape in the Delnorte-Canutio association, undulating.**

In the Delnorte soils, the surface layer typically is light-brown very gravelly loam about 8 inches thick. This is underlain by indurated caliche about 14 inches thick. Below the caliche is gravelly fine sand.

The Canutio soils typically have a surface layer of pale-brown very gravelly sandy loams about 11 inches thick. Underlying this layer are alluvial sediments that consist of very gravelly sandy loam several feet thick.

Included in mapping are small areas of Bluepoint soils and Badlands.

Part of this association is used for range, military purposes, recreation, housing, and commercial developments. Some of the acreage is idle.

The potential plant community consists chiefly of grass decreasers, such as side-oats grain. Arizona cottontop, plains bristlegrass, bush muhly, black grama, sand dropseed, and perennial three-awns. These grasses produce about 50 percent of the air-dry herbage grown annually on these soils. The principal increasers are fluffgrass, hairy tridens, and shortleaf tridens. Woody increasers are range ratany, dalea, and skeletonleaf goldeneye. Common invaders are creosotebush, lechuguilla, ocotillo, mesquite, broom snakeweed, cactus, and annual grasses and forbs. (Capability unit VIIs-1; Gravelly range site of the Desert Shrub vegetative zone)

**Delnorte-Canutio association, hilly** (DCD).—This mapping unit occurs on uplands in the western and northwestern parts of the county, where it lies in the foot hills of the Franklin Mountains. About 60 percent of the unit is Delnorte soils, 20 percent is Canutio soils, and the rest is inclusions of other soils. The Delnorte soils are on the hills, and the Canutio soils are in the arroyos and drainageways between the hills. The association occupies oblong-shaped areas that range from 500 to 3,000 acres in size. Delnorte soils are in irregularly shaped areas of 300 to 2,500 acres. Canutio soils are in oblong areas of 100 to 600 acres. Slopes range from 5 to 8 percent on ridgetops and in arroyos, and they are as much as 30 percent on hillsides.

Typically, the surface layer of Delnorte soils is pinkish-gray to pale-brown gravelly loam about 6 inches thick. Just below are layers of white or whitish, strongly cemented to indurate caliche. The combined thickness of these caliche layers is about 24 inches.

The Canutio soils typically have a surface layer of pale-brown, very gravelly sandy loams about 11 inches thick. Underlying this layer are alluvial deposits of pale-brown very gravelly sandy loam several feet thick.

Included in areas mapped as this association are small areas of Agustin, Lozier, and Bluepoint soils and Badlands.

Most of this association is idle. Some areas are used for housing, commercial developments, range, military purposes, or recreation.

The potential plant community on these soils is made up of such grass decreasers as side-oats grama, blue grama, green sprangletop, cane bluestem, and plains bristlegrass. The principal increasers are black grama, hairy grama, fall witchgrass, perennial three-awns, and chino grama. About 5 percent of the plant community, by weight, is woody increasers such as range ratany, dalea, and skeletonleaf goldeneye. Common invaders are creosotebush, lechuguilla, ocotillo, cactus, and annual grasses and forbs. (Capability unit VIIs-8; Limestone Hills range site of the Desert Shrub vegetative zone)

### Dune land

Dune land (DU) consists of active sand dunes that are 2 to 10 feet high, 10 to 40 feet wide, and 25 to 100 feet long. These dunes are formed by noncalcareous, very pale brown fine sand. Between them is soil material made up of fine sand that is 12 to 20 inches thick and is underlain by loamy fine sand several feet deep. Each time that strong winds cause a sandstorm, the dunes are changed in position and shape.

Dune land is not suitable for cultivation, and it provides little grazing for livestock. The only vegetation is scattered plants of sand sagebrush, yucca, and mesquite. These plants grow in circular patches 30 to 50 feet across and 50 to 200 feet apart. (Capability unit VIIIe-1; range site not assigned)

### Hueco series

Soils of the Hueco series are brown, sandy, noncalcareous, and mildly or moderately alkaline. They developed over outwash sediments from the nearby mountains. Hueco soils are underlain by an indurated caliche layer at it depth of 20 to 40 inches.

The surface of these soils is plane in some areas and concave in others. Slopes range from 0.5 to 1.5 percent. The soils are well drained and have medium internal drainage, slow surface runoff, and moderately rapid permeability. Their fertility and available moisture capacity are low. Soil blowing is a severe hazard in unprotected areas.

All the acreage of these soils is used for range, military establishments, housing, and commercial developments, or is idle.

In El Paso County the Hueco soils were mapped only in an association with the Wink soils.

Typical profile of a Hueco loamy fine sand, located in a pasture, 18 feet south of fence, 47 feet west of right-of-way marker, 109 feet south of yield sign on south side of junction of U.S. Highway No. 180 and Farm Road 659 east of El Paso:

A1—0 to 4 inches, brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; structureless; apparently winnowed and wind shifted; loose; few roots; noncalcareous and mildly alkaline; gradual, irregular boundary.

B21t—4 to 18 inches, brown (7.5YR 5/4) light fine sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard very friable; few roots; few clay bridges between sand grains; noncalcareous and mildly alkaline; clear, irregular boundary.

B22t—18 to 26 inches, yellowish-brown (10YR 5/6) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak granular structure; soft, friable; few roots and fine pores; few threads and films of calcium carbonate; thin, patchy clay skins; calcareous and moderately alkaline; abrupt, irregular boundary.

C1cam—26 to 58 inches, pinkish-white (7.5YR 5/2) caliche, indurated in upper part, less cemented with depth.

C2—58 to 80 inches +, pinkish-gray (7.5YR 7/2) loam, pinkish gray (7.5YR 6/2) moist; structureless; soft, very friable; 15 to 20 percent visible carbonates in the form of fragments and soft lumps; calcareous and moderately alkaline.

The combined thickness of the horizons above the C1cam in horizon ranges from 20 to 40 inches. The profile is usually dry between the depths of 7 and 20 inches. Texture of the A horizon is fine sand to loamy fine sand. When the A horizon is dry, it has a hue of 5YR to 7.5YR, a value of 5 to 6, and a chroma of 4 to 6. Texture of the B21t horizon is heavy loamy fine sand to light fine sandy loam. When dry, the B21t horizon is 7.5YR to 10YR in hue, 5 to 6 in value, and 4 to 6 in chroma. The dry color of the B22t horizon is 7.5YR to 10YR in hue, 5 to 6 in value, and 4 to 6 in chroma. The weighted average content of clay in the B2t horizons ranges from 8 to 15 percent. The thickness of the C1cam horizon ranges from 24 to 72 inches. Texture of the C2 horizon ranges from loamy fine sand to clay loam.

**Hueco-Wink association, hummocky** (HW).—This mapping unit occurs mainly in a single large area of about 200,000 acres in the northern and central parts of the county. A few areas in the eastern part of the county are about 100 acres in size and irregular in shape.

Hueco loamy fine sand makes up about 45 percent of the total acreage. Wink fine sandy loam and loamy fine sand cover about 35 percent. The remaining 20 percent consists of included small areas of other soils.

The Hueco soil generally lies in the lower and more nearly level parts of the association. It occurs in areas that range from less than 100 acres to about 2,000 acres in size. The Wink soils ordinarily are at the higher elevations, where slopes are greater, in areas that range from less than 100 acres to 1,000 acres in size. Wink soils also occur in an intricate pattern with the Hueco soil in the central part of the association. Here, the Wink soils are at a lower elevation than the Hueco soil.

The surface of the Hueco soil is plane in some areas and concave in others. Slopes range from 0.5 to 1.5 percent. The Wink soils have a plane to convex surface and slopes of 1 to 3 percent.

The Hueco soil typically has a surface layer of brown, loose heavy loamy fine sand that is 4 inches thick and is noncalcareous and mildly alkaline. Next is a subsoil of brown and yellowish-brown fine sandy loam that extends to a depth of about 26 inches. Below the subsoil is a layer of indurated caliche about 32 inches thick.

The Wink soils typically have a surface layer of pale-brown, friable fine sturdy loam that is about 6 inches thick and is calcareous and moderately alkaline. It is underlain by a subsoil of light yellowish-brown, friable, calcareous, moderately alkaline fine sandy loam that extends to a depth of about 24 inches. Below this depth is a layer of caliche, about 50 inches thick, that is strongly cemented in the upper part but is softer with increasing depth. Mixed alluvial deposits underlie the caliche layer.

Included with this mapping unit are areas of Turney and Berino soils; sand dunes; eroded areas where indurated caliche is less than 20 inches below the surface; and sandy soils that are deeper than 40 inches.

All the acreage of this mapping unit is used for range, military establishments, housing, and commercial developments, or is idle. The soils are highly susceptible, to blowing unless they are protected. They have a low organic-matter content and are low in fertility and available moisture capacity.

About 75 percent of the potential plant community on these soils is made up of such mid-grass decreasers as mesa dropseed, spike dropseed, blue grama, black grama, and plains bristlegrass. The principal increasers are sand dropseed and perennial three-awns. Common invaders are mesquite, creosotebush, and broom snakeweed.

Most of the range on these soils has deteriorated and consists chiefly of stabilized sand dunes that are covered with mesquite, creosotebush, and annuals (fig. 21). Before the rains begin in summer, the soil between the dunes is bare. (Capability unit VIe-2; Sandyland range site of the Desert Shrub vegetative zone)

***Figure* 21.—Sand dune covered with mesquite bushes. Hueco-Wink association, hummocky.**

### Igneous rock land

Igneous rock land (IG) consists of very steep outcrops of andesite or syenite rock. This land type occupies two areas in the counties. One area, about 570 acres

in size, is near the University of Texas at El Paso in the southwestern part of the county. Here, outcrops of andesite have been weathered to very fine gravel that supports scattered plants of creosotebush and range ratany.

Igneous rock land also occurs at Hueco Tanks, a recreational area about 30 miles east of El Paso. Here, almost vertical outcrops of syenite rise as much as 100 feet above the surrounding landscape. This area of outcropping rock occupies about 600 acres (fig. 22).

***Figure* 22.—Igneous rock land at Hueco Tanks.**

This land type is of no use for farming. It is used mainly for recreation and as building sites. The Sun Bowl is located on this land, and the campus of the University of Texas at El Paso is built around and on the lower slopes of this land in the southwestern part of the city of El Paso. (Capability unit VIIIs-I; range site not assigned)

### Igneous rock land-Brewster association

Igneous rock land-Brewster association (IN) makes up part of the Franklin Mountains in western El Paso County, and it also occupies small areas in the Hueco Mountains in the northeastern part of the county. The mapping unit occurs in areas that range from 100 acres to several hundred acres in size and are irregular in shape. Slopes are steep or very steep (fig. 23).

In areas mapped as this association, from 50 to 75 percent of the acreage is Igneous rock land; 15 to 50 percent is Brewster soils; and the rest, is included small areas of Delnorte and Agustin soils.

Igneous rock land occupies the upper and steeper parts of the association, where it occurs as long, wide areas of exposed, stratified igneous rocks, mostly granite, andesite, syenite, and rhyolite. These areas are 50 to several hundred acres in size. Slopes range from 30 percent to almost vertical escarpments several hundred feet thick.

The Brewster soils occupy the lower and less sloping parts of the association. They lie in areas of 15 to several hundred acres. These soils typically have a surface layer of dark reddish-brown, mildly alkaline stony clay loam about 10 inches thick. Just below the surface layer is igneous bedrock. Slopes range from 10 to 30 percent and are convex.

***Figure* 23.—Landscape in the Igneous rock land-Brewster association.**

Most of this association is idle, but some of it is used for recreation, and a small acreage is used for range. Although the soils have low fertility and available moisture capacity, they are friable and take in water readily, and most of the water is stored if rainfall is light, if rainfall is heavy, however, runoff is rapid, and erosion is a severe hazard in areas that are unprotected by grass.

Igneous rock land generally is inaccessible to livestock, and the Brewster soils produce most of the forage that can be used by grazing animals. The potential plant community on these soils is made up of such decreaser grasses as side-oats grama, green sprangletop, bush muhly, blue grama, and plains bristlegrass. The principal increasers are black grama, slim tridens, fall witchgrass, and perennial three-awns. Desirable woody plants, such as range ratany, dalea, sotol, yucca, lechuguilla, and skeletonleaf goldeneye, make up about 5 percent of the plant community, by weight. Common invaders are catclaw and some kinds of annual grasses and forbs. If the range is in excellent condition, the average annual yield of air-dry herbage varies from 440 to 640 pounds per acre, depending on amount and distribution of rainfall.

(Capability unit VIIs-9. Igneous rock land: range site not assigned. Brewster soils; Igneous Mountains range site of the Desert Grassland vegetative zone)

### Limestone rock land-Lozier association

Limestone rock land-Lozier association (LM) comprises most of the Hueco Mountains in the eastern part of the county, and it occurs in the Franklin Mountains in the western part. The mapping unit is in irregularly shaped areas that range from 50 acres to several hundred acres in size.

About 50 percent of the mapping unit is Limestone rock land; 35 percent is Lozier soils; and 15 percent is included small areas of Simona, Agustin, and Delnorte soils that lie at the base of mountains and on hilly foot slopes.

Limestone rock land occupies the upper and steeper parts of the association, where it occurs as wide, long areas of exposed, stratified limestone bedrock. These areas are 30 to several hundred acres in size. Slopes range from 30 percent to almost vertical escarpments.

The Lozier soils are in the lower and less sloping parts of the association, between the areas of exposed limestone. Here, the soils lie in areas of 20 to several hundred acres.

Typically, the surface layer of Lozier soils is pinkish-gray, calcareous stony loam. This layer is only about 5 inches thick and is underlain by limestone bedrock. Lozier soils have convex slopes ranging from 10 to 30 percent.

All the acreage in this association is used for range or recreation or is idle. The soils are friable and readily take in water, and they can store the moisture from light rains. They are so stony and so shallow, however, that much of the water from heavy rains runs off. Surface drainage is rapid, and erosion is a severe hazard unless the soils are protected by grass.

The potential plant community is made up of such glasses as side-oats grama, green sprangletop, big muhly, New Mexico feathergrass, cane bluestem, plains bristlegrass, and blue grama. The principal increasers are black grama, hairy grama, fall witchgrass, perennial three-awns, Hall's panicum, and slim tridens. About 5 percent of the plant community, by weight, is woody increasers that include agarita, range ratany, lechuguilla, ocotillo, sotol, and dalea, and skeletonleaf goldeneye. Common invaders are broom snakeweed and many kinds of annuals.

Limestone rock land is generally inaccessible to livestock, and the Lozier soils provide most of the range and the forage available for grazing animals. If the range is in excellent condition, the average annual yield of air-dry herbage varies from 440 to 640 pounds per acre, depending on amount and distribution of rainfall. (Capability unit VIIs-9. Limestone rock land: range site not assigned. Lozier soils: Limestone Mountains range site of the Desert Grassland vegetative zone)

**Lozier series**

The Lozier series consists of very shallow, pinkish-gray, stony soils that are calcareous and moderately alkaline. These soils developed over limestone. They occur on stony limestone hills, mostly near the mountains in the western and eastern parts of the county.

In most areas the surface of these soils is convex, but in some it is concave. Slopes range from 5 to 30 percent. The soils are well drained, have rapid surface runoff, and are low in available moisture capacity.

Most of the acreage is used for range. Some of it is idle or used for recreation.

Typical profile of a Lozier stony loam, located in a pasture 100 feet east of Hueco Tanks Load, 0.8 mile north of U.S. Highway No. 180, 6.2 miles east of the junction of that highway and Farm Road 659 east of El Paso:

A1—0 to 5 inches, pinkish-gray (7.5YR 6/2) stony loam, brown (7.5YR 5/2) moist; weak subangular blocky structure; slightly hard, friable; fragments of caliche-coated limestone as much as 1 foot across the long axis; these fragments make up about 60 percent of the volume of the soil; calcareous and moderately alkaline; abrupt boundary.

R—5 inches +, hard limestone containing a few cracks filled with caliche.

In most years the soil is usually dry in all parts. The depth to limestone ranges from 2 to 8 inches. In places a layer of soft whitish caliche, 1 inch thick or less occurs over the limestone. When the A1 horizon is dry, it has a hue of 10YR to 7.5YR, a value of 5 to 6, and a chroma of 2 to 3.

**Lozier association, hilly** (LOD).—This mapping unit consists mainly of moderately steep soils on rounded to oval-shaped hills near the Franklin and Hueco Mountains. The association lies in areas that range from 40 to 200 acres in size.

Lozier stony loams, the major soil, makes up about 65 percent of the association. Exposed limestone bedrock occupies about 20 percent, and small areas of included soils occupy the remaining 15 percent.

The Lozier soil generally has a convex surface, but in shall areas its surface is concave. Slopes range from 5 to 30 percent. Between areas of the Lozier soil, limestone crops out as ledges that are ½ foot to 3 feet thick and 5 to 10 feet apart.

Typically, the Lozier soil has a surface layer of pinkish-gray, calcareous, moderately alkaline stony loam about 5 inches thick. This layer overlies hard limestone bedrock. Fragments of limestone, some as ranch as 12 inches long, make up about 60 percent of the surface layer, by volume.

Included in areas mapped as this association are small areas of Wink, Simona, and Agustin soils. Also included, where fine association lies adjacent to Hueco soils or to Dune land, are areas of Lozier soils that have been covered by windblown sand as much as 6 feet deep. These sand-covered auras generally are on the west and north sides of the hills.

Most of this association is used for range. Some of the acreage is idle, and some is used for recreation.

The potential plant community is made up of such mid-grass decreasers as side-oats grama, blue grama, green sprangletop, cane bluestem, and plains bristlegrass. The principal increasers are black grama, hairy grama, fall witchgrass, perennial three-awns, and chino grama. About 5 percent of the plant community, by weight, consists of woody increasers such as range ratany, dalea, lechuguilla, ocotillo, and skeletonleaf goldeneye. (Common invaders are creosotebush, cactus, and annual grasses and forks. (Capability unit VIIs-8; Limestone Hills range site of the Desert Shrub vegetative zone)

### Mimbres series

Soils of the Mimbres series are deep, light brownish gray, calcareous, moderately alkaline, and loamy. They developed from outwash that was deposited by small streams draining the nearby mountains. These soils lie in shallow water courses and playas of upland valleys, where they still receive sediments washed from higher areas.

The surface of these soils is concave. Slopes range from less than 1 percent to about 2 percent. Although the soils are moderately well drained, in places they may be ponded for 3 to 7 days. Permeability is moderately slow in the surface layer and subsoil. Fertility and the available moisture capacity are high.

In most places the Mimbres soils are used for range. Some areas are idle or used for recreation.

Typical profile of a Mimbres silt loams, located in a pasture 44 feet west of pasture road, 0.2 mile north of the Old Butterfield Trail, 2.6 miles west of Hueco Tanks Road, 4.5 miles north of U.S. Highway Nos. 62 and 180, 14.5 miles east of El Paso:

A1—0 to 8 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium, platy structure; slightly hard, friable; calcareous and moderately alkaline; clear, wavy boundary.

B2—8 to 50 inches, brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; very weak prismatic structure; slightly hard, friable; contains a few films and threads of calcium carbonate; calcareous and moderately alkaline; clear, wavy boundary.

C—50 to 60 inches +, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak granular structure to massive (structureless); soft, friable; few, fine,

soft concretions of calcium carbonate; calcareous and moderately alkaline.

These soils are usually dry between the depths of 7 and 20 inches. The A1 horizon is silt loam or loam and is grayish brown or light grayish brown in a hue of 10YR. The B2 horizon ranges from silt loam or loam to light silty clay loam. It has a clay content of 18 to 30 percent, and less than 15 percent of the material is coarser than very fine sand. In color the B2 horizon ranges from grayish brown to brown in a hue of 10YR. The structure of this horizon is weak subangular blocky to very weak prismatic. The accumulation of secondary carbonates in the C horizon varies from a few films and threads to a few, fine, soft concretions.

**Mimbres association, level** (MBA).—This mapping unit occurs in playas and in drainageways of intermittent streams of the intermountain basin in the eastern part of the county. It occupies areas that range from 20 to 200 acres in size. These areas are long and narrow in the drainageways and are oval shaped in the playas. Slopes are concave and, in some places, are as much as 2 percent.

The Mimbres soils make up about 85 percent of the total acreage. They occupy areas of 15 to 170 acres that lie in the lowest parts of the association. The Pajarito, Agustin, and Simona soils cover the remaining 15 percent of the acreage and are in areas of 5 to 30 acres. Agustin soils occur in small oval-shaped “islands,” and the Pajarito and Simona soils generally are at the higher elevations along the sides of areas mapped as this association.

Typically, the Mimbres soils have a surface layer of light brownish-gray, friable silt loam about 8 inches thick. This layer is calcareous and moderately alkaline. Below it is a subsoil of brown, friable, calcareous, moderately alkaline silt loam that extends to a depth of about 50 inches. The underlying material consists of loamy sediments that are high in lime content.

The potential plant community is made up of such decreasers as blue grama, vine-mesquite, side-oats grama, cane bluestem, Arizona cottontop, plains bristlegrass, and bush muhly. Among the decreasers are alkali sacaton, tobosagrass, four-wing saltbush, and perennial three-awns. Common invaders are burrograss, tarbush, creosotebush, ephedra, and mesquite.

This association now produces the most range forage of any in the county, and it has the highest potential for improvement. Depending on variations in rainfall, the average animal yield of air-dry herbage varies from 600 to 750 pounds per acre. In places where as much as 3 inches of runoff from higher areas enters these soils annually, brush eradication and reseeding are feasible. (Capability unit VIc-1; Draw range site of the Desert Shrub vegetative zone)

### Pajarito series

The Pajarito series consists of deep, pinkish-gray, loamy soils that are calcareous and moderately alkaline. These soils developed on alluvial fans or old terraces. They occur just above the Rio Grande flood plain and on alluvial fans in intermountain basins in the northern and eastern parts of the county.

The surface of these soils is plane in some areas and is concave in others. Slopes range from less than 1 percent to about 3 percent. The soils are well drained and have moderate permeability in their surface layer and subsoil. Fertility and the available moisture capacity are moderate. Soil blowing and water erosion are hazards in unprotected areas.

Most of the acreage is used for range. Some of it is used for irrigated crops, housing and commercial developments, and military establishments or is idle.

Typical profile of a Pajarito fine sandy loam, located in a cultivated field 100 feet north of field road, 1,460 feet east of U.S. Highway No. 50, 3.2 miles south of the junction of that highway and Farm Road 1908 in Anthony:

Ap—0 to 18 inches, pinkish-gray (7.5YR 6/2) heavy fine sandy loam, brown (7.5YR 4/2) moist; weak subangular blocky structure; hard, friable; calcareous; gradual boundary.

B2—18 to 36 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak subangular blocky structure; hard, friable; few lime threads; calcareous; clear boundary.

Cca—36 to 60 inches +, light yellowish-brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak subangular blocky structure; hard, friable; contains a few fine concretions and a few threads and films of calcium carbonate; calcareous.

Unless they are irrigated, the Pajarito soils are usually dry between the depths of 7 and 20 inches. The A horizon ranges from loam to fine sandy loam in texture. When this horizon is dry, it ranges from pinkish gray to pale brown in color; its hue is 7.5YR to 10YR, value is 5 to 6, and chroma is 2 to 4. The B2 horizon, when dry, is brown to yellowish brown and has a hue of 7.5YR to 10YR, a value of 5 to 6, and a chroma of 3 to 4. This horizon ranges from loam to fine sandy loam and has a clay content of less than 18 percent. In some places a bed of gravel occurs at a depth of 36 to 40 inches. Pebbles of limestone or igneous rock, or both, make up 0 to 15 percent of the A and B2 horizons, by volume. In most places these pebbles are coated with caliche.

**Pajarito association, level** (PAA).—This mapping unit occurs on alluvial fans in the intermountain basins and on terraces above the Rio Grande flood plain. The soils are gently sloping on the fans and are level or nearly level on the terraces. They occupy areas that range from 50 to 1,000 acres in size. These areas are generally rectangular in shape and are longest in the direction that parallels the flood plain or the mountains.

Pajarito soils are dominant in the association. They lie in areas of 35 to 750 acres that stake up about 75 percent of the total acreage. Other soils in the association are the Agustin, Simona, Bluepoint, Turney, Wink, and Mimbres. These soils occupy areas of 10 to 250 acres. Any one of the soils, or all of them, can occur in a given area mapped as this association.

The Pajarito soils have a surface layer of pinkish-gray, friable, calcareous, moderately alkaline fine sandy loams about 18 inches thick. The subsoil is light-brown, friable fine sandy loam that extends to a depth of about 36 inches. It also is calcareous and moderately alkaline. Underlying the subsoil is light yellowish-brown fine sandy loam that contains a few concretions of calcium carbonate.

If the soils in this association are not protected, they are susceptible to water erosion and blowing. They are well drained and moderately permeable. Runoff is medium to rapid, depending on slope and intensity of rainfall. Fertility and the available moisture capacity are moderate. In areas where water is available in sufficient quantity and is not too saline, the soils can be irrigated for cultivated crops.

Most of this association is used for range. Some of the acreage is used for housing, commercial developments, or military purposes, or is idle. An area of about 1,000 acres is irrigated in this county. The area extends from Anthony along the east side of U.S. Highway No. 80 almost to Canutillo. The principal crops grown are cotton, alfalfa, and grain sorghum. Also well suited under irrigation are truck crops, sudangrass, and small grains. Among the practices needed to supply organic matter and control erosion are cover cropping, growing crops that produce

a large amount of residue, and managing the residue properly. Land leveling by grading the soil into benches will help to check water erosion. Lining the ditches reduces excessive loss of irrigation water.

The potential plant community on these soils is made up of such grass decreasers as black grama, plains bristlegrass, mesa dropseed, and bush muhly. The principal increasers are perennial three-awns, sand dropseed, range ratany, four-wing saltbush, and skeletonleaf goldeneye. Common invaders are fluffgrass, mesquite, tarbush, creosotebush, and broom snakeweed. (Capability unit IIe-2, irrigated; Ve-1, dryland; Sandy Loam range site of the Desert Shrub vegetative zone)

**Simona series**

The Simona series consists of brownish-gray, gravelly, loamy soils that are calcareous and moderately alkaline. These soils occur in the eastern part of the county near the Hueco Mountains, where they developed in outwash material from the mountains. They have a layer of indurated caliche within a depth of 20 inches.

The surface of these soils is plane in some auras and concave in others. The soils have good drainage, rapid surface runoff, moderate permeability, and low available moisture capacity. They are subject to water erosion.

The Simona soils are used mostly for range, but in some areas they are used for military purposes or are idle.

Typical profile of a Simona gravelly loams, located in a pasture 100 feet, west of Hueco Tanks Road, 0.9 mile north of the junction of Hueco Tanks Road and U.S. Highway No. 62 and 180; Hueco Tanks Road is 6.5 miles east of the junction of Farm Road 659 and U.S. Highway No. 62 and 180 east of El Paso:

A1—0 to 3 inches, light brownish-gray (10YR 6/2) gravelly loams, dark grayish brown (10YR 4/2) moist; weak platy structure in upper part, weak subangular blocky structure in the lower part; slightly hard, friable; plentiful fine roots; 30 percent, by volume, strongly cemented caliche fragments, limestone fragments, and caliche-coated limestone pebbles that range from $^{1}/_{8}$ inch to 2 inches across; calcareous and moderately alkaline; clear lower boundary.

B2—3 to 16 inches, pale-brown (10YR 6/3) gravelly fine sandy loam, brown (10YR 4/3) moist; weak subangular blocky structure; slightly hard, friable; few, fine roots; 30 percent, by volume, caliche fragments and caliche-coated limestone pebbles $^{1}/_{8}$ inches to 2 inches across; calcareous and moderately alkaline; abrupt boundary.

C1cam—16 to 60 inches, whitish, indurated caliche; the upper ¼ to ½ inch is laminated; cementation is less with increasing depth; embedded pebbles make up 10 percent of horizon, by volume; abrupt boundary.

C2—60 to 72 inches +, pale-brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; structureless; soft, very friable; 60 percent, by volume, angular pebbles of caliche-coated limestone and caliche fragments $^{1}/_{8}$ inch to 2 inches across; calcareous, moderately alkaline.

These soils are usually dry between the depths of 7 and 20 inches. The horizons above the C1cam horizon have a combined thickness ranging from 8 to 20 inches. The average organic-matter content to a depth of 15 inches or to the depth of the C1cam horizon, whichever is less, is more than 0.7 percent. The A1 and B2 horizons range from gravelly loam to gravelly fine sandy loam in texture and from 10 to 15 percent in clay content. Coarse fragments make up 15 to 35 percent of the A1 and B2 horizons. When the A1 horizon is dry, it has a hue of 7.5YR to 10YR, a value of 6 to 7, and a chroma of 2 to 4. When moist, the B2 horizon is 7.5YR to 10YR in hue, 5 to 6 in value, and 3 to 6 in chroma. The upper

½ inch or less of the caliche layer is laminar. The caliche is strongly cemented to indurated.

**Simona association, undulating** (SMB).—This mapping unit is made up of gently sloping and undulating soils on foot slopes and outwash plains of the Hueco Mountains. These soils occupy areas that range from 200 to 2,000 acres in size. The areas generally are rectangular in shape, and their longer axis is parallel to the mountains.

The major soils are the Simona, which lie in areas of 150 to 1,800 acres and make up about 65 percent of the association. Other soils are the Agustin and Wink; these soils are in areas of 20 to 200 acres, and they make up about 10 percent of the total acreage, but they do not occur in all areas mapped as this association. The remaining 25 percent consists of an included soil in which the surface layer is gravelly loam and a layer of indurated caliche is deeper than 20 inches below the surface.

The Simona soils typically have a surface layer of light brownish-gray, friable, calcareous, moderately alkaline loam about 3 inches thick. The subsoil is pale-brown, friable fine sandy loam that is calcareous and moderately alkaline. It extends to a depth of 16 inches. About 30 percent of the surface layer and subsoil, by volume, is caliche and caliche-coated fragments or pebbles of limestone $^{1}/_{8}$ inch to 2 inches across. Just below the subsoil is an indurated caliche layer.

The soils in this mapping unit receive runoff from the nearby mountains, and they are subject, to erosion unless protected. If rainfall is heavy, most of the water runs off, but it is readily taken into the soil if the rain is gentle. Drainage is good, and permeability is moderate, but the available moisture capacity is low.

Most of the acreage is used for range. Some of it is used for military purposes, and some is idle.

The potential plant community consists of grass decreasers, such as side-oats grama, Arizona cottontop, plains bristlegrass, bush muhly, black grama, sand dropseed, and perennial three-awns. The principal grass increasers are fluffgrass, hairy tridens, and shortleaf tridens. Woody increasers include range ratany, dalea, lechuguilla, ocotillo, and skeletonleaf goldeneye. Common invaders are creosotebush, mesquite, broom snakeweed, cactus, and some kinds of annual grasses and forbs. (Capability unit VIIs-1; Gravelly range site of the Desert Shrub vegetative zone)

### Turney series

The Turney series consists of light reddish-brown, calcareous, moderately alkaline soils that are moderately deep to weakly cemented caliche. These soils developed over outwash material from the nearby mountains. They occur at the lower elevations in the Hueco Bolson in the northern part of the county.

The surface of these soils is plane to slightly convex. Slopes range from less than 1 percent to about 2 percent. The soils are well drained, are moderately permeable, and have high available moisture capacity. Areas nearest the mountains receive runoff from higher slopes.

The Turney soils are used chiefly for range, residential and commercial developments, and military establishments. About 600 acres is used for irrigated crops.

In El Paso County the Turney soils were mapped only in an association with the Berino soils.

Typical profile of a Turney fine sandy loam, located in a pasture 200 feet south of a fence on a paved county road, 1.5 miles east of the intersection of this county road and Farm Road 2529; this intersection is 6 miles north of U.S. Highway No. 54 via Farm Road 2529:

A11—0 to 3 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) moist; structureless; winnowed; soft, very friable; calcareous and moderately alkaline; clear boundary.
A12—3 to 10 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; moderate, fine, subangular blocky structure; hard, friable; few threads and films of calcium carbonate; calcareous and moderately alkaline; gradual boundary.
B2—10 to 34 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/1) moist; moderate, fine, subangular blocky structure; hard, friable; common fine threads and films of calcium carbonate; a few soft concretions of calcium carbonate in lower part; calcareous and moderately alkaline; clear boundary.
C1ca—34 to 60 inches, pinkish-white (7.5YR 8/2) caliche that is clay loam in texture; structureless; weakly cemented in upper part, soft and powdery below; gradual boundary.
C2—60 to 80 inches +, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; structureless; soft, very friable; 3 to 5 percent of horizon is gravel; pebbles $^1/_8$ to ¾ inch in diameter; calcareous and moderately alkaline.

The profile is usually dry between the depths of 7 and 20 inches. The combined thickness of the horizons above the horizon ranges from 23 to 40 inches. The A horizon ranges from fine sandy loam to loam in texture. In color this horizon is reddish brown to light brown in a hue of 5YR to 7.5YR. The B horizon is clay loam or sandy clay loam; it has a clay content of 20 to 35 percent. The B horizon ranges from light reddish brown to brown. It has a hue of 5YR to 7.5YR, a value of 5 to 6, and a chroma of 3 to 4. The structure of the Bt horizon ranges from weak subangular blocky to moderate prismatic. The calcium carbonate content in the C1ca horizon ranges from 15 percent, by volume, of soft masses and finely disseminated particles to 50 percent, by volume, of weakly cemented caliche, whose texture is about clay loam.

**Turney-Berino association, undulating** (TBB).—This mapping unit occupies areas in the intermountain basin in the northern part of the county. It extends from the New Mexico State line into the northern part of the city of El Paso. The largest area, about 27,000 acres in size, lies in a north-south direction and is roughly rectangular in shape, though it is wider toward the north. A few small areas of the mapping unit are in the northeastern part of the county.

The major soils are the Turney, which make up about 75 percent of the association and occupy areas ranging from 500 to 5,000 acres in size. The Berino soils make up about 20 percent of the association and are in areas of 200 to 3,000 acres. Included in mapping are areas of Pajarito and Hueco soils; these inclusions account for the remaining 5 percent of the total acreage.

The surface of Turney soils is plane or slightly convex. Slopes range from less than 1 to about 2 percent. The Berino soils have a concave surface, and their slopes are less than 1 percent.

The Turney soils typically have a surface layer of light reddish-brown, friable fine sandy loam about 3 inches thick. The surface of this layer has been winnowed by wind. Next is a subsurface layer of light-brown, friable loams almost 7 inches thick. Both layers are calcareous and moderately alkaline. The subsoil is light-brown, calcareous, moderately alkaline clay loam that extends to a depth of about 34 inches. The lower part of the subsoil contains threads and concretions of lime. Below it is a 26-inch layer of weakly cemented, pinkish-white caliche that is about clay loam in texture and is soft and powdery in the lower part. The underlying

sediments consist of soft, light-brown fine sandy loam. Figure 24 shows a typical profile of a Turney fine sandy loam.

Typically, the Berino soils have a brown, friable fine sandy loam surface layer that is about 8 inches thick and is noncalcareous and mildly alkaline. It overlies a subsurface layer of brown loam about 5 inches thick. This layer also is noncalcareous and mildly alkaline. The subsoil is yellowish-red and brown clay loam that contains a few soft concretions of calcium carbonate. The subsoil extends to a depth of about 37 inches. It is underlain by light-brown, calcareous, moderately alkaline loam in which the content of visible carbonates is about 10 percent, by volume.

Drainage is good in the Turney soils and is moderately good in the Berino soils. In some areas the Berino soils may be ponded for a few days after heavy rain. Soils of both series have high available moisture capacity and moderately slow permeability.

Most of the acreage in this mapping unit is used for range, military purposes, and residential and commercial developments. In areas where water is available in sufficient quantity and is not too saline, the soils can be cultivated under irrigation. Presently, about 600 acres is used for irrigated crops, principally alfalfa, corn for silage, and grain sorghum.

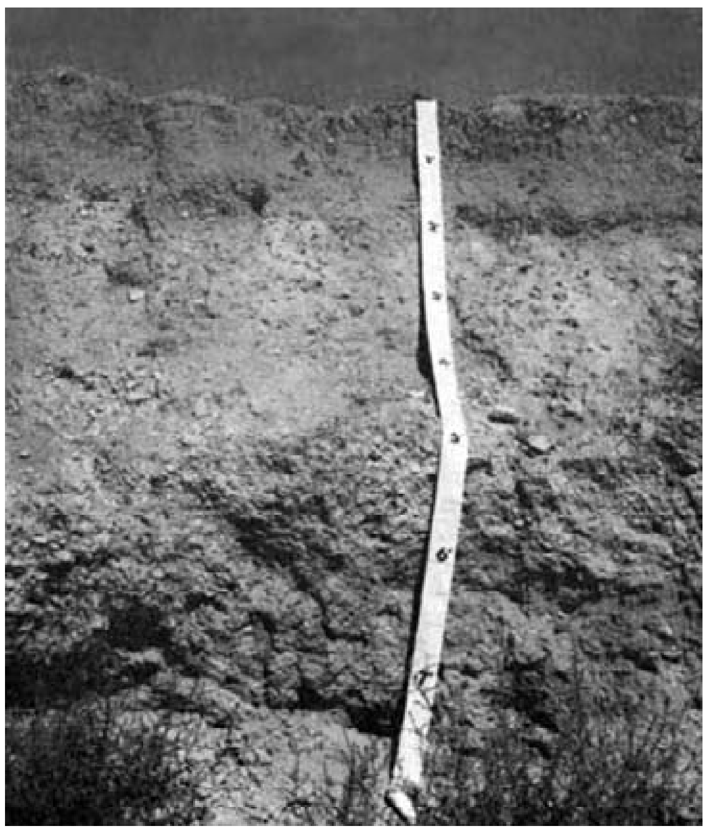

***Figure* 24.—Profile of a Turney fine sandy loam.**

The potential plant community on these soils is made up of such grass decreasers as bush muhly, black grama, perennial three-awns, plains bristlegrass, mesa dropseed, and sand dropseed. The principal decreasers are short three-awns, burrograss, sand muhly, tobosagrass, ear muhly, and tarbush. Common invaders are mesquite, creosotebush, and broom snakeweed. (Capability unit IIe-1, irrigated; VIe-1, dryland; Deep Upland range site of the Desert Shrub vegetative zone)

**Wink series**

The Wink series is made up of pale-brown, calcareous, moderately alkaline soils that are moderately steep to cemented caliche. These soils developed on alluvial fans in closed basins in the northeastern and eastern parts of the county.

The surface of Wink soils is plane or slightly concave. Slopes range from less than 1 to about 2 percent. Drainage is good. Permeability, fertility, and the available moisture capacity all are moderate. Soil blowing and water erosion are hazards in unprotected areas.

In most places the Wink soils are used for range. Some of the acreage is used for military purposes, and some of it is idle.

Typical profile of a Wink fine sandy loam, located in a pasture 38 feet north of a road, 3.8 miles west of Hueco Tanks Road, 4.5 miles north of U.S. Highway Nos. 180 and 62:

A1—0 to 6 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak; platy structure in upper part, structureless (massive) in lower part; slightly hard, friable; few fine roots and pores; calcareous and moderately alkaline; clear boundary.

B2—6 to 24 inches, light yellowish-brown (10YR 6/3) fine sandy loam, dark yellowish-brown (10YR 4/4) moist; weak prismatic structure; slightly hard, friable; roots plentiful in upper part, few in lower part; fine pores common in upper part, few in lower part; few (less than 1 percent) fine pebbles of limestone and fine fragments of calcium carbonate; few lime threads and concretions of calcium carbonate; calcareous and moderately alkaline; abrupt, wavy boundary.

C1ca—24 to 73, whitish, strongly cemented caliche in layers and fragments ½ inch to 1 ½ inches thick. Hardness is less than 3.

C2—73 to 100 inches +, pale-brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; structureless; soft, very friable; 60 percent be volume, caliche-coated angular limestone pebbles and caliche fragments $^1/_8$ inch to 2 inches across; calcareous and moderately alkaline.

The profile is usually dry between the depths of 7 and 20 inches. Depth to the C1ca horizon ranges from 20 to 40 inches. The A1 horizon ranges from 3 to 15 inches in thickness and from loam to fine sandy loam in texture. When this horizon is dry, it has a hue of 7.5YR to 10YR, a value of 6 to 7, and a chroma of 2 to 4. Some pebbles of limestone and igneous rock occur in the A1 and B2 horizons, but they make up less than 5 percent of these horizons. When dry, the B2 horizon has the same range in color as the A1 horizon. The B2 horizon has a clay content of 8 to 18 percent, and more than 15 percent of the horizon is coarser than loamy very fine sand. The C1ca horizon is weakly to strongly cemented, but its hardness is less than 3.

**Wink association, level** (WKA).—This mapping unit consists of level and nearly level soils that lie in broad upland valleys in the northeastern and eastern parts of the county (fig. 25). The areas range from 100 to about 5,000 acres in size and are irregular in shape.

Wink soils are dominant; they make up about 80 percent of the association and are in areas of 80 to 4,000 acres. Most of the remaining acreage consists of Pajarito, Agustin, Simona, and Mimbres soils. These soils are in areas of 20 to 250 acres.

The Wink soils typically have a surface layer of pale-brown, friable fine sandy loam that is about 6 inches thick and is calcareous and moderately alkaline. Next is a subsoil of light yellowish-brown, friable, calcareous, moderately alkaline fine sandy loam that extends to a depth of about 24 inches. This layer is underlain by whitish,

strongly cemented caliche that is about 50 inches thick. Below the caliche is brown, friable, calcareous, moderately alkaline gravelly loam.

***Figure* 25.—Landscape in the Wink association, level. In the background is Igneous rock land, a miscellaneous land type.**

Included in areas mapped as this association are small areas of soils that are similar to the Wink but contain a caliche layer at a depth of more than 40 inches.

Most of the acreage in this mapping unit is used for range, but some is used for military purposes and some is idle.

Such mid-grass decreasers as black grama, plains bristlegrass, side-oats grama, mesa dropseed, and bush muhly make up about 65 percent of the potential plant community. The principal increasers are perennial three-awns, sand dropseed, and sand muhly. About 5 percent of the plant community is woody increasers, such as range really, four-wing saltbush, and skeletonleaf goldeneye. Common invaders are annual gramas, fluffgrass, mesquite, tarbush, creosotebush, and broom snakeweed. (Capability unit VIe-1; Sandy Loam range site of the Desert Shrub vegetative zone)

## Interpreting Soils by Capability Classification

Some readers, particularly those who practice large-scale farming, may find it practical to use and manage alike some of the different kinds of soils on their farms. These readers can make good use of the capability classification system, a grouping that shows, in a general way, how suitable soils are for most kinds of farming.

In the capability system, all the kinds of soil are grouped at three levels—the class, the subclass, and the unit. Following is a descriptive outline of the system as it applies in El Paso County. The placement of any mapping unit in the grouping can be learned by turning to the “Guide to Mapping Units, (Removed)” at the back of this survey, or by referring to the notation that ends the description of each mapping unit in the section that described the soils of the county.

The capability units are not numbered consecutively in this county, because not all of the capability units used in a multicounty area of Texas are in El Paso County.

Class I. Irrigated soils that have few limitations that restrict their use.
(No subclasses)
Capability unit I-1.—Deep, nearly level soils that have a silty clay loam surface layer, on the Rio Grande flood plain.
Capability unit I-2.—Deep, nearly level soils that have a loam surface layer, on the Rio Grande flood plain.

Class II. Irrigated soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
Subclass IIe. Soils subject to moderate erosion if they are not protected.
Capability unit IIe-1.—Nearly level and gently sloping soils that have a fine sandy loam surface layer and a clay loam subsoil, moderately deep to weakly cemented caliche.
Capability unit IIe-2.—Deep, nearly level and gently sloping soils that generally are fine sandy loam throughout.
Capability unit IIe-3.—Deep, nearly level, moderately permeable soils that have a fine sandy loam surface layer and a stratified loamy subsoil, on the Rio Grande flood plain.
Subclass IIs. Soils that have moderate limitations of moisture capacity or tilth.
Capability unit IIs-2.—Deep soils that have a silty clay surface layer and a silty clay loam subsoil, on the Rio Grande flood plain.
Capability unit IIs-3.—Deep, slowly permeable soils that have a silty clay loam surface layer underlain by stratified loamy and sandy material, on the Rio Grande flood plain.

Class III. Irrigated soils that have severe limitations that reduce the choice of plants, require special conservation practices, or both.
Subclass IIIs. Soils that have severe limitations of moisture capacity or tilth.
Capability unit IIIs-1.—Deep, very slowly permeable soils that have a silty clay surface layer underlain by clay or by clay and fine sand, on the Rio Grande flood plain.
Capability unit IIIs-4.—Deep, very slowly permeable soils that have a silty clay loam surface layer underlain by clay over loamy fine sand, on the Rio Grande flood plain.
Capability unit IIIs-5.—Deep, permeable soils that have a fine sandy loam surface layer underlain by loamy fine sand and thin layers of very fine sandy loams and fine sand, on the Rio Grande flood plain.

Class IV. Irrigated soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
Subclass IVs. Soils that have very severe limitations of moisture capacity or tilth.
Capability unit IVs-3.—Deep, rapidly permeable soils that have a loamy fine sand surface layer underlain by fine sand, on the Rio Grande flood plain.
Capability unit IVs-4.—Deep, gently sloping to undulating soils that have a gravelly loam surface layer and a gravelly subsoil.

Class V. Dryland soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture, range, or wildlife food and cover. (None in El Paso County.)

Class VI. Dryland soils that have severe limitations that make them unsuitable for cultivation and that limit their use largely to range or wildlife food and cover.
Subclass VIe. Soils severely limited, chiefly by risk of erosion, if protective cover is not maintained; these soils can be cultivated under irrigation.
Capability unit VIe-1.—Nearly level and gently sloping, moderately permeable soils that are deep or moderately deep to cemented caliche, on upland alluvial plains.
Capability unit VIe-2.—Sandy, rapidly permeable soils that are moderately steep to indurated caliche, in the Hueco Bolson.

Subclass VIc. Soils that are severely limited by climate and are not suitable for cultivation unless irrigated.

Capability unit VIc-1.—Deep, loamy, moderately permeable soils.

Class VII. Dryland soils that have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to grazing or wildlife.

Subclass VIIe. Soils very severely limited, chiefly by risk of erosion, if protective cover is not maintained.

Capability unit VIIe-1.—Deep, rolling, sandy, rapidly permeable soils of the uplands.

Subclass VIIs. Soils very severely limited by moisture capacity, stones, or other soil features.

Capability unit VIIs-l.—Undulating, gravelly soils that are deep or are shallow to hard caliche, on uplands.

Capability unit VIIs-8.—Very shallow, stony, hilly soils of mountain foot slopes.

Capability unit VIIs-9.—Very shallow, stony, very steep soils and exposed rock of the mountains.

Class VIII. Dryland soils and land forms that have limitations that preclude their use, without major reclamation, for commercial production of plants; and restrict their use to recreation, wildlife, or esthetic purposes.

Subclass VIIIe. Extremely erodible soil material.

Capability unit VIIIe-1.—Active sand dunes.

Subclass VIIIs. Rocky, clayey, or gullied land that has little potential for production of vegetation.

Capability unit VIIIs-1.— Very steep outcrops of igneous rock and steep, barren clay hills.

As shown in the foregoing list, the broadest grouping, time capability class, is designated by Roman numerals I through VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclass indicates major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e, w, s*, or c, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c* indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils are subject to little or no erosion but have other limitations that confine their use largely to pasture, range or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other response to management. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIs-4.

Soils are classified in capability classes, subclasses, and units in accordance with degree and kind of their permanent limitations; but without considering major and generally expensive alterations that could be made in the slope, depth, or other characteristics of the soil, and without considering possible but unlikely major reclamation projects.

Good management of irrigated soils in all capability units requires the use of an irrigation system that has been properly designed. In El Paso County, where the soils are irrigated only by surface methods, installing a well-designed system includes land leveling, construction of suitable ditches, and regulating the length of rows or borders.

In managing irrigated soils of the county, subsurface drainage and accumulations of toxic salts are only minor concerns. In some places, however, irrigation water having a high salt content has been recently used, and if such use is continued, the salinity in the soils is likely to increase.

## Predictions of Crop Yields

Table 3 lists predicted average acre yields of cotton and alfalfa that can be expected on irrigated soils in El Paso County under improved management. The yields shown are not presumed to be the highest obtainable, but they set a goal that is practical for most farmers to reach if they use good management.

To obtain the yields listed in table 3, the following measures are used.

1. Soil-improving crops, cover crops, and crops that produce a large amount of residue are included in the cropping system.
2. Crop residues are properly managed.
3. Irrigation water is applied according to the needs of the crop.
4. Fertilizer is used in amounts indicated by soil tests.
5. Tillage, seeding, and harvesting are done at the right time and in the right way.
6. Weeds, insects, and plant diseases are controlled.
7. Improved varieties of crops are grown.
8. Soil salinity is controlled.

The yields shown are based on the assumption that a given soil makes up an entire field. If two dissimilar soils, such as Gila loam and Tigua silty clay, occur in the same field so that crops are grown in rows that cross both soils, the predicted yields are for the dominant soil. On the other soil in the field, yields likely are lower than those listed. This difference in production is partly the result of difference in available moisture capacity and the rate of water intake. If crops on the dominant soil are irrigated properly, those on the other soil probably are underirrigated or overirrigated.

## Range Sites and Condition Classes

By Richard W. Reed, district conservationist, and R.J. Pederson, range conservationist, Soil Conservation Service

In El Paso County, only seven ranches are operated and ranching is relatively unimportant, economically. Rangeland in the county is grazed seasonally, mainly by cattle.

Different kinds of rangeland produce different kinds and amounts of grass and other vegetation. In order to manage rangeland properly, a rancher should know the different kinds of soil on his ranch and the plants that will grow on each range site. The soils of El Paso County and the plants that will grow on the soils used for range are discussed in the section “Descriptions of the soils.”

A range site is a distinctive kind of rangeland that differs from other kinds in its potential for producing native plants. Within a given climate, the sites differ only in the kind and amount of vegetation they will produce. These differences are the result of varying soil characteristics, such as depth, texture, position in the landscape, exposure, and elevation.

Throughout the rangeland of this county, the potential plant community on a given site consists of the combination of plants that were growing there when the county was first settled. Generally, it is the most productive combination of forage plants that will grow on the site.

Grass, as well as all other green plants, manufactures its food in the leaves and stems. Consequently, the growth and reproduction of range plants are directly affected by the amount of grazing the plants receive. Under heavy grazing or overuse, the leaves and stems are reduced or destroyed. The result is a corresponding reduction in the amount of food received to maintain the plants and allow them to grow. If heavy grazing is continued over a period of years, many of the plants die.

Livestock tend to graze the most palatable and nutritious plants first, and therefore these plants are destroyed or damaged first. Plants that generally decrease under close grazing are called *decreasers.* The stand is thinned as decreasers are eliminated. Then, less palatable plaints, known as increasers and invaders, move in. *Increasers* tend to increase at first under heavy grazing but are the next plants to be reduced or eliminated. As the decreasers and increasers are eliminated, the condition of the range continues to decline and successively less desirable plants are dominant in the site. Finally, plants from other sites or from distant areas invade the plant community. These plants are known as *invaders.*

By this process, the plant composition of the range site, or the range condition, changes from excellent to poor. A range is in *excellent* condition if more than 75 percent of the present vegetation consists of the original plant community; in *good* condition if 50 to 75 percent consists of the original plant community; in *fair* condition if 25 to 50 percent consists of original plants; and in *poor* condition if less than 25 percent consists of original plants.

Most of the native grassland in El Paso County has been heavily grazed for many years, and the original plant cover has been materially changed. In the western part of the county, however, the cover of grass is good on the slopes of the Franklin Mountains. Here, a general lack of water for livestock has nearly prohibited grazing. These slopes likely will not be used for range in the future, because of a great demand for recreational areas near the city of El Paso.

Two vegetative zones occur in the county. The Desert Shrub vegetative zone occupies areas where the elevation is below 4,500 feet and the average annual rainfall is less than 10 inches. In this zone the natural plant cover consists of shrubs, grasses, and forbs. The Desert Grassland vegetative zone lies at elevations above 4,500 feet in the Franklin and Hueco Mountains. In this zone the average yearly rainfall is more than 10 inches, the climate is cooler, and the natural vegetation consists mainly of grasses but includes some shrubs and forbs.

For the mapping units within the low-intensity survey, the “Guide to Mapping Units, (Removed)” at the back of this publication lists the range site in which a given unit has been placed. For the same mapping units, range sites and vegetative zones are listed at the end of individual descriptions in the section “Descriptions of the Soils.”

## Engineering Uses of Soils

By Nelton O. Salch, civil engineer, Soil Conservation Service

This section provides information of special interest to engineers, contractors, farmers, and others who use soils as structural material or as foundation material on which structures are built. Soil properties affect the construction and maintenance of roads, airports, and pipelines, the foundations of buildings, facilities for storing water, structures for controlling erosion, drainage systems, and systems for disposing of sewage.

Among the soil properties most important in engineering are permeability to water, shear strength, compaction characteristics, water-holding capacity, shrink-swell characteristics, grain size, plasticity, and reaction. Also important are depth to bedrock, to a cemented layer, or to sand and gravel, the hazard of flooding, and relief.
The information in this survey can be used to—

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils that will help in planning drainage systems, ponds, irrigation systems, waterways, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables and assist in planning detailed investigations of the selected locations.
4. Locate probable sources of sand, gravel, rock, or fill material.
5. Correlate performance of engineering structures with soil mapping units, and thus develop information for overall planning; that will be useful in designing and maintaining certain engineering practices and structures.
6. Estimate the suitability of soil units for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and from aerial photographs.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

With the use of the soil map for identification, the engineering interpretations in this section can be useful for many purposes. It should be emphasized that they may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Much of the information in this section is in tables 4, 5, 6, and 7. Table 4 lists engineering data that were obtained when selected soils in the county were tested. In table 5 are estimated engineering properties of the soils and in tables 6 and 7 are engineering interpretations of the soils.

Some of the terms used by soil scientists may be unfamiliar to engineers, and some words have a special meaning in soil science. Many of these terms are defined in the Glossary at the back of this publication.

**Engineering Classification Systems**

Two systems of classifying soils are in general use among engineers, the Unified classification system *(10)* and the system adopted by the American Association of State Highway Officials (AASHO) (*1*). Both are used in this soil survey.

The AASHO system is based on field performance of highways in relation to soils. The soils having the same general load-carrying capacity are grouped together in seven basic groups. These groups range from A-1 (gravelly soils of high bearing capacity, the best soils for subgrade) to A-7 (clayey soils having low bearing capacity when wet, the poorest soils for subgrade). In each group the relative engineering value of the soil material is indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. The group index number is shown in parentheses following the soil group symbol (in this soil survey, the group index number is shown only in table 4).

In the United classification, the soils are grouped on the basis of their texture and plasticity and their performance as material for engineering structures. In this system, soil material is divided into 15 classes; 8 classes are for coarse-grained material, 6 for fine-grained material, and 1 for highly organic material. Mechanical analyses are used to determine the GW, GP, SW, and SP classes of material; mechanical analyses, liquid limit, and plasticity index are used to determine GM, GC, SM, SC and fine-grained material.

**Engineering Test Data**

Samples that represent nine soil series were taken from 18 locations in El Paso County and were tested by the Texas Highway Department according to standard procedures of the American Association of State Highway Officials. The data obtained from these tests are given in table 4. The table also gives two systems of engineering classification—the AASHO system and the Unified system. Some terms used in table 4 are discussed in the paragraphs that follow.

Lineal shrinkage is the decrease in one dimension of the soil when the moisture content is reduced from a given percentage to the shrinkage limit. Lineal shrinkage is expressed as a percentage of the original dimension.

The tests for the liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which a soil passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

**Estimated Engineering Properties**

Table 5 shows some estimated soil properties that are important in engineering, and it gives the Unified and AASHO classifications for the soils. The estimates are based on test data listed in table 4, on knowledge gained through field experience, on information given in the section “Descriptions of the Soils” and elsewhere in the survey, and on data for the same or similar soils obtained in other survey areas. The textural terms used to describe the soil material are those used by the U.S. Department of Agriculture.

The depth to bedrock has been omitted from the table because most soils in the county are 5 feet deep or more. Some of the soils, however, are less than 5 feet deep or contain a strongly cemented or indurated layer that affects engineering uses. The Brewster soils typically are only 10 inches deep over granite. In the Delnorte soils, strongly cemented caliche begins at a depth of about 6 inches. Generally, the Hueco soils contain a layer of indurated caliche at a depth of about 2 inches. The Lozier soils are about 5 inches deep to hard limestone. In the Simona soils, indurated caliche occurs at a depth of about 16 inches. The Wink soils contain strongly cemented caliche at a depth of about 24 inches.

Permeability refers to the rate that water moves downward through undisturbed and uncompacted soil. It depends largely on soil structure and porosity.

Available water capacity is the maximum amount of water a soil can hold available to plants. It is the water held in the range between field capacity and the wilting point.

The shrink-swell potential indicates how much a soil changes in volume when its moisture content changes. Soils having a high shrink-swell potential generally are undesirable from an engineering standpoint.

Not listed in table 5 are the estimated salinity of the soils, their reaction, and the corrosion potential for untreated metal pipelines laid underground. Salinity normally is

not of great concern in the high-intensity survey area, where water for irrigation is obtained from the Rio Grande. In areas where irrigation water is pumped from wells, an investigation is needed at each site to determine the risk of excess salts accumulating in the soils.

The pH, or reaction, of soils in El Paso County ranges from 7.5 to 8.5.

For uncoated steel pipes, the corrosion potential is very high in all the soils in the high-intensity survey area. In soils of the low-intensity survey area, the corrosion potential is high or very high.

### Engineering Interpretations of the Soils

Tables 6 and 7 rate the soils of El Paso County as sources of material for engineering uses, and they list specific features that affect the suitability of the soils for engineering structures. Detrimental or undesirable features are named if they are important. The interpretations are based on information in tables 4 and 5 and on field experience and performance.

Although the information in tables 6 and 7 applies specifically to soil depths indicated in table 5, it is reasonably reliable to a depth of about 6 feet for most soils and to a greater depth for some soils.

Topsoil is fertile soil material that is used for top-dressing areas where vegetation is to be grown, such as lawns, gardens, and roadbanks. Ordinarily, topsoil is rich in organic matter.

Suitability as a source of sand and gravel is rated according to the probability that a given soil contains one or both of these materials. The ratings do not indicate the size of the deposits or the quality of the material.

Suitability as a source of road fill is determined mainly by texture, plasticity, compaction characteristics, and the amount of material available at the source.

Among the features that affect highway location are relief, hazard of flooding, plastic soil material, depth to bedrock or other restricting layer, and susceptibility to water erosion and soil blowing.

Dikes and levees are low structures designed to impound or divert water. Susceptibility to piping, shrink-swell hazard, stoniness, and depth of soil to bedrock or to indurated caliche are among the features affecting these uses.

In considering agricultural drainage (table 6), the main features that influence the design of an efficient system are soil permeability and stability of the soil material.

Features that affect the use of soils for reservoir areas of farm ponds (table 7) include permeability and seepage rate; slope; gravel, stones, or cobblestones; and rock or indurated candle near the surface. As a rule, the features considered for the embankments of farm ponds are the same as those for dikes and levees.

Among the soil features affecting irrigation are the rate of water intake, the available moisture capacity, soil depth, slope, susceptibility to water erosion and soil blowing, and the flooding hazard.

Diversions are channels that have a supporting ridge on the lower side and are built across the slope to divert runoff from its natural course. Thus, they protect areas downslope from the effects of such runoff. Soil features that affect the construction of diversions include stability, slope, depth, and hazard of erosion.

## Community Development

In recent years, especially since 1950, the city of El Paso has grown rapidly. This growth has taken place mainly on soils that formerly were used for range. Most, of the newcomers have been persons who came from parts of the country where the climate and soils differ greatly from those in El Paso County. When these persons tried to plant lawns, gardens, trees, and shrubs by using methods that had been

successful elsewhere, they learned that such methods commonly fail in this part of Texas.

## Use of Soils in Community Development

In El Paso County the soils have a high content of lime, are alkaline, contain little organic matter, and lose water rapidly through evaporation. Other features also limit the use of soils in rapidly growing areas of business and housing. Tables 8 and 9 list the soil limitations that affect selected uses in developing communities. This information is helpful to realtors, city planners, builders, and others who are concerned about soil properties that influence the choice of sites for homes, other buildings, septic tank filter fields, streets and parking lots, and recreation.

The low humidity, accompanied by high temperatures and strong winds, causes a rapid loss of moisture in the uppermost 1 or 2 inches of a soil if the surface is left bare. This loss is most likely to occur in places where a new lawn or garden is being established. In addition, the high content of lime in the soils tends to make phosphates, as well as iron and other minor elements, unavailable to plants.

Among the other features that affect the use of soils in community development are the organic-matter content, soil texture, content of gravel, and depth to a hard layer, or caliche.

Organic matter or humus is important in keeping soils mellow, well aerated, and in good tilth. In El Paso County, however, the soils formed under a plant cover consisting mainly of desert shrubs, and their organic-matter content is naturally low.

Soils that are very shallow to hard caliche, such as the Delnorte soils, have a low available moisture capacity. Some areas of these soils are so shallow to the caliche layer that a lawn cannot be maintained unless additional soil material is brought in to increase the depth of the root zone. Also, the Delnorte soils, as well as the Hueco soils, are poorly suited to deep-rooted trees and shrubs. In many places it is necessary to remove the layer of caliche before deep-rooted plants can develop an adequate rooting system.

The Agustin, Delnorte, and other gravelly soils are of limited use for lawns and gardens because of their gravel or stone content.

The Bluepoint, Hueco, and other sandy soils have a low available moisture capacity, and if plants are successfully grown on these soils, irrigation water must be applied frequently and in small amounts.

In tables 8 and 9 the features that limit the use of soils as filter fields for septic tanks are rated slight, moderate, severe, or very severe. If the limitations are rated moderate, severe, or very severe, the chief limitations are listed. Among the soil features that affect this use are absorptive capacity of the soil, permeability, depth, and slope. Also important are the level of the ground water and the proximity of a site to a stream or other body of water (*8*). A rating of *slight* indicates that any limitation affecting use of the soil is not important. A rating of *moderate* shows that a moderate restriction is recognized but can be overcome or corrected by means that generally are practical. A rating of *severe* indicates that use of the soil is questionable because the limitation is difficult to overcome. A rating of *very severe* means that the limitation is so restrictive that use of the soil is impractical. Tables 8 and 9, along with the detailed soil map at the back of this publication, are useful in determining the general suitability of selected areas as filter fields for septic tanks, but an investigation should be made at a proposed site before a septic tank system is installed.

Following are explanations of other uses listed in tables 8 and 9:

*Foundations for buildings of three stories or less.*—These foundations are for homes and for buildings used as stores, offices, schools, churches, and small industrial plants. None of these buildings requires a presumptive hearing value of more than 6,000

pounds. It is assumed that a public or a community system for disposing of sewage is available. The soil features that affect this use include slope, depth to bedrock or hard caliche, height of the water table, hazard of flooding, and shrink-swell potential.

*Trafficways.*—These are low-cost roads, as well as streets in residential areas. The construction involves limited cuts and fills and limited preparation of subgrade. Properties important in evaluating the soils for this use are slope, depth to bedrock or hard caliche, height of the water table, hazard of flooding, risk of erosion, traffic-supporting capacity, and shrink-swell potential. (For soil features affecting the construction of roads and streets for heavier traffic, refer to tables 6 and 7.)

*Intensive play areas.*—Athletic fields and other intensive play areas are fairly small tracts used for baseball, football, badminton, and other sports. Areas selected for these uses generally must be nearly level and well drained and have a texture and consistence that give a firm surface. In addition, the most desirable soils are free of rock outcrops, gravel, and stones. Other features affecting use are the hazard of flooding and wetness, permeability, slope, soil texture, depth to hard bedrock or caliche, and the erosion hazard.

*Parks or recreational areas.*—Important properties in evaluating soils used for parks, playgrounds, and similar recreational areas are the wetness hazard, risk of flooding, slope, texture of the surface layer, stoniness, rockiness, and the erosion hazard.

*Trafficability.*—This refers to the use of soils for unimproved roads that are built on the soil surface without making cuts or fills or laying down pavement of any kind. The limitations are those that affect the capacity of the soil to support vehicular traffic. Included are the risks of vehicles getting stuck in loose sand, the capacity of the soil to remain smooth after a moderate amount of traffic, susceptibility to gullying, stoniness, slope, and the hazard of flooding.

# *Formation and Classification of Soils*

The first part of this section discusses the factors that influence soil formation, and the second part deals with the classification of soils.

## Formation of Soils

Soil is produced by the action of soil-forming processes on material deposited or accumulated by natural forces. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Climate and living organisms, particularly vegetation, are the active forces of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determine it almost entirely. Finally, time is needed for the changing of the parent material into a soil. The amount of time may be short or long, but some time is always required for soil horizons to form. Usually a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

### Parent material

Most of El Paso County is underlain by intermontane sediments known locally as bolson deposits. These sediments were washed from the nearby mountains. They filled the basin that was formed during the uplift of the mountains and the faulting that occurred in the Tertiary Period and continued into the Quaternary Period. The basin in El Paso County, called the Hueco Bolson, was enclosed at first but was drained later when the Rio Grande made its present course (3). Since then, water from runoff and rain has leached the carbonates in the soil and formed the layers of caliche that occur at various depths below the surface. The soils that formed in this bolson are in the Merino, Delnorte, Hueco, Simona, Turney, and Wink series. Soils that occupy the lower part of the bolson have received more water than those in the higher part, and clay in these low-lying soils has been moved downward from the surface layer and has formed clay films on particles in the subsoil. These soils are in the Berino and Hueco series.

The mountains that were uplifted during the Tertiary Period consisted of limestone, igneous rock, and sandstone. These rocks were exposed as soil material was washed from the steeper slopes and laid down in the basin below. The exposed rocks have been mapped as land types, such as Igneous rock land and Limestone rock land. On the lower slopes of the mountains and on small hills of limestone, soils were formed in the weathered rock materials. Soils on the limestone hills are in the Lozier series, and those derived from igneous rocks are in the Brewster series.

The soils near the mountains and in playas and drainageways have developed in recent times and have not taken enough water through their profile for caliche layers to be formed or for clay to be moved from the surface layer to the subsoil. These soils are in the Agustin, Canutio, Timbres, and Pajarito series.

Soils on the flood plain of the Rio Grande formed in alluvium recently laid down by the river. The alluvium came from many kinds of rocks and soils in the Rio Grande watershed from El Paso to southern Colorado. These floodplain soils are in the Anapra, Brazito, Glendale, Gila, Harkey, Saneli, Tigua, and Vinton series.

When the Rio Grande cut through the Hueco Bolson, the water held in the basin drained away and the lakebed was exposed. The bed of the old lake consisted of deep material made up of clay and sand in thick layers. Where sand was at the surface, it was shifted about by wind. The Bluepoint soils formed in this sandy material. Exposed beds of clay have been mapped as Badlands, a miscellaneous land type.

### Climate

The main climatic forces that act on the parent material of soils are the amount and distribution of precipitation, and the temperature, humidity, and wind. Climate directly affects soil formation through its influence on weathering, leaching of carbonates, translocation of clay, reduction and transfer of iron, and rate of erosion. Climatic forces also cause some of the variations in the plant and animal life on and in the soils. They thus influence changes in the parent material that are the result of differences in the kinds of plants and animals.

The climate in El Paso County is arid. Winters are cool; summers are hot and dry. The major part of the annual precipitation falls in summer, and most of it is in the form of high-intensity thundershowers that cause erosion and, in lower areas, local flooding. Late in winter and in spring, high winds bring duststorms that remove soil material from one area and deposit it in another. Plants grow very little in spring because precipitation is light and humidity is very low. Consequently, the soil surface is poorly protected from strong winds and heavy rains.

The climate is nearly uniform throughout the county. Total precipitation is a little greater at higher elevations in the mountains than it is elsewhere. On the flood plain of the Rio Grande, minimum temperatures in winter are 10 to 15 degrees lower than

in surrounding areas and frost occurs later in spring and earlier in fall. More climatic data are given in the section “Additional Facts About the County.”

### Plant and animal life

Plants, micro-organisms, earthworms, and other forms of life on or in the soil are active in soil-forming processes. They provide organic matter, help to decompose plant residues, affect the chemistry of the soil, and hasten soil development. Living organisms also help to convert plant nutrients into a form readily available to higher plants. Some forms of life retard horizon differentiation by churning or mixing the soil.

Plants, mainly desert shrubs, have affected soil formation in this county more than other living organisms. Soils that formed under desert shrubs generally have a low organic-matter content.

Man has had little influence on soil formation except in irrigated areas. In these areas he has altered the soil by land leveling, deep plowing, and irrigating.

### Relief

Relief influences the formation of soils through its local effect on drainage and runoff, rate of erosion, plant cover, and exposure to sun and wind.

El Paso county ranges from nearly level on the flood plain of the Rio Grande to very steep in the mountains. Soils formed on the nearly level flood plain are deep. Soils formed in nearly level and gently sloping areas of the upland are underlain by deposits of caliche, which accumulated as runoff from the limestone mountains entered the soils and moved carbonates into the lower horizons. Also, water running off the limestone rocks keeps the soils recharged with lime. These are the Berino, Delnorte, Hueco, Simona, Turney, and Wink soils.

Soils have not developed in very steep areas of the mountains, where the rate of geologic erosion is about the same as that of soil formation. In less sloping areas of the mountains, the soils are shallow because runoff tends to remove the soil almost as fast as it is formed.

### Time

Time, generally a long time, is required for the formation of soils that have distinct horizons. Differences in the length of time that the parent material has been in place are commonly reflected in the degree of development of the soil profile.

The soils of El Paso county range from young to old. The young soils have very little profile development, but the older soils show well-developed horizons. The soils on the Rio Grande flood plain are examples of young soils. If dams and levees had not been built along the river; these soils would still receive sediments during periods of flooding.

Soils a little older than those on flood plains are the Agustin, Canutio, Mimbres, and Pajarito. These soils developed in alluvium recently washed from the mountains. They are old enough that, some structure has formed and some carbonates have accumulated as very fine concretions, films, and threads in the subsoil.

In soils still older, such as the Berino, Delnorte, Hueco, Simona, Turney, and Wink, there are thick, commonly very hard accumulations of caliche. This quantity of carbonates shows that the soils have been forming for a long time.

## Classification of Soils

Soils are classified so that we call more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop

principles that help us in understanding their behavior and their response to manipulation. First, through classification and then through the use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils call be organized and used in managing farms, fields, and rangeland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two system of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*5*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1905. The current system is under continual study, and readers who are interested in development of this system should read the latest literature available (*7*, *4*).

In table 10, each soil series in El Paso County is placed in its family, subgroup, and order of the current classification system. Placement of some soil series in the current system may change as more precise information becomes available.

## Additional Facts About the County

Long before the Spaniards conquered Mexico, the area that is now El Paso County was inhabited by tribes of Pueblo Indians. Ysleta, the oldest settlement in Texas, was established by Spanish priests and explorers in 1681. The ford of the Rio Grande and the pass through the mountains became an important way station for the Spaniards, who called it El Paso del Norte, “the Pass of the North.” In the early 1800’s, American settlers began to come westward. By 1827 El Paso del Norte was an active frontier town, a station of the road from Sante Fe to Mexico City and a stopping off place for westward-bound pioneers (*9*).

The area of the present El Paso County was first settled by Spaniards, Mexicans, and a few Americans. The influx of American settler’s was slow because attacks by Indians were frequent, food was scarce and expensive, and transportation by oxcart was difficult and dangerous. In 1868 a county government was established, and in 1873 the city of El Paso was incorporated and a municipal government was established. At that time, El Paso County included the present counties of Culberson and Hudspeth. In 1874 the county seat was moved to Ysleta, but since 1883 El Paso has been the county seat (*9*).

### Climate

The climate of El Paso County is characterized by an abundance of sunshine throughout the year, by high but not extremely high daytime temperatures in summer, and by very low humidity, scanty rainfall, and relatively cool winters typical of arid areas. Temperature and precipitation data, as recorded by the U.S. Weather Bureau (Environmental Science Services Administration) at El Paso, are shown in table 11.

Rainfall in the county is too light for the growth of any vegetation except desert plants. Consequently, irrigation is necessary for farm crops, gardens, and lawns. Dry periods that last for several months without appreciable rainfall are not unusual. More than half of the yearly precipitation occurs in summer during brief, but at times heavy, thunderstorms. Small amounts of snow fall nearly every winter, though snow cover rarely amounts to more than an inch and seldom remains for more than a few hours.

In summer the daytime temperature frequently rises above 90° F. and occasionally above 100°, but most summer nights are comfortable because the temperature usually falls to the 60’s. The average number of days in which the temperature reaches 100° or higher is 10 per year. The highest temperature on record in the county is 109°, recorded on June 21, 1960, and again on July 3, 1960.

Winter days are usually mild, for the temperature on an average day in winter rises to 55° to 60°. The temperature drops below freezing on about half the nights in December and January. A temperature below 10° is rare; it has occurred on only 28 days in more than 80 years of record, though an extreme of -8° has been recorded. The nearly level, irrigated valley of the Rio Grande in the vicinity of El Paso is noticeably cooler, particularly at night, than the airport or the city itself, both in summer and in winter. This results in more comfortable temperatures in the irrigated areas in summer, but it increases the severity of frosts in winter. The cooler air in the valley also causes short-period fluctuations of temperature and dewpoint at times when the direction of the wind changes, especially during the early morning hours.

The relative humidity averages about 51 percent at 6:00 a.m., 35 percent at noon, 26 percent at 6:00 p.m., and 40 percent at midnight. If the temperature is high, the relative humidity generally is quite low. At times when the temperature is above 90° in April, May, and June, the average humidity is between 10 and 14 percent. When the temperature is above 90° in July, August, and September, the average humidity is between 22 and 24 percent. This low humidity aids the efficiency of evaporative air coolers, which are widely used in homes and public buildings and are effective in cooling the air to a comfortable temperature.

The average length of the freeze-free season is 248 days. The average date of the last occurrence of 32° in spring is March 9, and the average date of the first occurrence of 32° in fall is November 12.

Sunshine is abundant the year round; it averages about 83 percent of the total time possible annually. Because the climate is arid, evaporation is high. The average annual evaporation from Weather Bureau pans 4 feet in diameter is about 105 inches. The average annual evaporation from lakes is approximately 72 inches.

Duststorms and sandstorms are unpleasant features of the weather in El Paso. Although the wind velocity is not excessively high, the soil surface generally is dry and loose and natural vegetation is sparse. For this reason, a moderately strong wind raises a considerable amount of sand and other soil particles. A tabulation of duststorms, for a period of 20 years, shows that these storms are most frequent in March and April. They are comparatively rare in fall, though they can occur at any time of year.

The prevailing wind is northerly a little more than half of the time, but it is from the north in winter and from the south in summer.

## Relief and Drainage

Among the major physiographic features that make up El Paso county are (1) the flood plain of the Rio Grande; (2) an old dissected terrace, or lakebed, that lies northeast of, and roughly parallel to, the flood plain; (3) the Hueco Bolson, a large basin that is partly closed and slopes to the west and south; (4) the Franklin Mountains in the western part of the county; and (5) the Hueco Mountains in the eastern part of the county.

The flood plain of the Rio Grande extends from New Mexico southward to the city of El Paso, thence southeastward to the Hudspeth County line, a total distance of 60 miles. The flow of the river is in these directions. At Anthony the elevation of the flood plain is about 3,700 feet, and at the Hudspeth county line it is about 3,500 feet.

The Hueco Bolson is in the central and southeastern parts of the county. It has an average elevation of about 4,000 feet.

The southerly end of the Franklin Mountains lies within the city of El Paso, and the northerly end extends a few miles into New Mexico. The top of the mountains is a narrow ridge that runs in a north-south direction. North Mt. Franklin, the highest point, is 7,120 feet above sea level.

The Hueco Mountains extend along the eastern side of the county from New Mexico to an area about halfway between that state and the Rio Grande flood plain. These mountains rise to an elevation of about 5,500 feet.

The western and southern slopes of the Franklin Mountains are drained into the Rio Grande. The eastern slopes of these mountains, as well as all of the Hueco Mountains in El Paso county, drain into the Hueco Bolson, where the drainage water is absorbed or evaporated before it can reach the Rio Grande. The old dissected terrace, or lakebed, northeast of the flood plain is drained into the Rio Grande.

### Farming

Deep deposits of fertile soil material have been laid down in the Rio Grande Valley. These deposits are especially suitable for producing cotton, grains, fruits, nuts, corn, and vegetable crops. Because the annual rainfall is low, all crops grown in the valley must be irrigated. Water for irrigation is obtained mainly from the reservoir behind Elephant Butte Dam in New Mexico. This dam, together with delivery canals and drainage ditches, makes up an irrigation project that was completed in 1916.

Most of the soils used for farming along the Rio Grande have been altered in one way or another. Old channels of the river have been filled and leveled; sandy material has been added to clayey soils to make the surface layer less clayey; and clayey material has been mixed into the surface layer of sandy soils.

All of the irrigation water from the Elephant Butte Dam is delivered to farms and fields through gravity flow. This water contains 0.7 ton to 1.3 tons of soluble salts per acre-foot. Consequently, farmers generally apply a large amount of water before planting crops so that excess salts are leached from the root zone. During periods when water from the irrigation project is in short supply, wells are used for obtaining additional water. Some of these wells supply water having a higher content of salts than water from the river. As a result, in fields where this well water is used, periodic leaching is needed to keep the soils from becoming too saline for most crops.

## Literature Cited

(1) American Association of State Highway Officials. 1961. Standard Specifications for Highway Materials and Methods of Sampling and Testing. Ed. 8, 2 v., illus. Washington, D.C.

(2) Baldwin, M., Kellogg, C. E., and Thorp, James. 1938. Soil Classification. U.S. Dept. Agr. Ybk.: 979-1001. illus.

(3)Davis, M. E., And Leggat, E.R. 1965. Reconnaissance Investigations of the Ground-Water Resources of the Rio Grande Basin, Texas. Texas Water Commission Bul. 6502, 99 pp., illus.

(4) Simonson. Roy W. 1962. Soil Classification in the United States. Sci. 137: 1027-1034.

(5) Thorp, James, and Smith. Guy D. 1949. Higher Categories of Soil Classification: Order, Suborder, and Great Soil Group. Soil Sci. 67: 117-126.

(6) United States Department of Agriculture. 1951. Soil Survey Manual. Agr. Handbook 18, 503 pp., illus.

(7)1960. Soil Classification, A Comprehensive System. 7th Approximation. 265 pp., illus. [Supplement issued in March 1967]

(8)1961. Soils Suitable for Septic Tank Filter Fields. Agr. Info. Bul. No. 243. 12 pp., illus.

(9) University of Texas. 1949. An Economic Survey of El Paso County. College of Business Research, Bureau of Business Research.

(10) University of Texas. 1953. The Unified Soil Classification System. Tech. Memo. No. 3-357, 2 v. and appendix. 44 pp.. illus.

206 pp., illus.

(10) Waterways Experiment Station, Corps of Engineers.

# Glossary

**Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

**Available moisture capacity.** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at Wilting point. It is commonly expressed as inches of water per inch of soil.

**Bolson.** An extensive intermountain basin that generally is closed, or has no outlet. A flat-floored desert valley that drains to a playa. Term is used locally in the Southwest.

**Bolson deposits.** Sediments laid down by water in an intermountain basin.

**Calcareous soil.** A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

**Caliche.** A more or less cemented deposit of calcium carbonate in many soils of warm-temperature areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the soil or it may be exposed at the surface by erosion.

**Clay.** As a soil separate. the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Clay film.** A thin coating of clay on the surface of a soil aggregate.

**Coarse fragments.** Rocks and minerals in the soil that are larger than 2 millimeters in diameter. They include gravel, cobblestones, stones, and boulders.

**Concretion.** A local concentration of compounds that irreversibly cement soil grains together.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

*Loose.*—Noncoherent; will not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a “wire” when rolled between thumb and forefinger.

*Sticky.*—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

*Hard.*—When dry, moderate resistance to pressure; can be broken with difficulty between thumb and forefinger.

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard and brittle; little affected by moistening.

**Flood plain.** Nearly level land, consisting of stream sediments that borders a stream and is subject to flooding unless protected artificially.

**Gravel.** A soil separate made up of pebbles, rounded or angular, that have a diameter ranging from 2.0 to 80 millimeters. The content of gravel is not used in determining the textual class of a soil.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

*O horizon.*— The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

*A horizon.*—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and it is therefore marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

*B horizon.—The* mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has (1) distinctive characteristics caused by accumulation of clay, sesquioxides, humus, or some combination of these; (2) prismatic or blocky structure; (3) redder or stronger colors than the A horizon or (4) some combination of these. The combined A B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

*C horizon.*—The weathered rock material immediately beneath the solum. This layer, commonly called the soil parent material, is presumed to be like that from which the overlying horizons were formed in most soils. If the underlying material is known to be different from that in the solum, a Roman numeral precedes the letter C.

*R layer.*—Consolidated rock beneath the soil. The rock generally underlies a C horizon but may be immediately beneath the A or B horizon.

**Internal soil drainage.** The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by the height of the water table. Relative terms for expressing internal drainage are *none, very slow, slow, medium, rapid*, and *very rapid.*

**Lacustrine deposits.** Material that has been deposited in lake water and then exposed when the water level lowered or the land rose.

**Leaching.** The removal of material in solution by water passing through the soil.

**Permeability.** The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

**Playa.** The shallow central basin of a desert plain, in which water gathers after a rain and is evaporated.

**Profile, soil.** A vertical section of the soil through all its horizons and extending into the parent material.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that has a pH of 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid soil is one that gives an acid reaction; and alkaline soil is one that is alkaline in reaction. In words, the degree of alkalinity or acidity are expressed thus:

| | *pH* |
|---|---|
| Extremely acid | Below 4.5 |
| Very strongly acid | 4.5 to 5.0 |
| Strongly acid | 5.1 to 5.5 |
| Medium acid | 5.6 to 6.0 |
| Slightly acid | 6.1 to 6.5 |

| | *pH* |
|---|---|
| Neutral | 6.6 to 7.3 |
| Mildly alkaline | 7.4 to 7.8 |
| Moderately alkaline | 7.9 to 8.4 |
| Strongly alkaline | 8.5 to 9.0 |
| Very strongly alkaline | 9.1 and higher |

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Runoff.** The surface flow of water over an area. The amount and rapidity of runoff are affected by texture, structure and porosity of the surface soil; by vegetation; by prevailing climate; and by slope. The degree of runoff is expressed by the terms: *Very rapid, rapid, medium, slow, very slow,* and *ponded.*

**Sand.** Individual rock or mineral fragments in solids having diameters ranging from 0.05 millimeter to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

**Silt.** Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

**Solum.** The upper part of a soil profile, generally consisting of the combined A and B horizons. If a soil lacks a B horizon, the A horizon alone is the solum.

**Structure, soil**. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are *single grain* (each grain by itself, as in dune sand), or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

**Subsoil.** Technically, the B horizon.

**Substratum.** Any layer beneath the solum, or true soil; the C or R horizon.

**Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil. The plowed layer.

**Terrace (geology).** A nearly level or undulating plain that commonly is rather narrow, generally has a steep from, and borders a river, a lake, or the sea.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loams classes may he further divided by specifying “coarse,” “fine,” or “very fine.”

**Topsoil.** A presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

**Upland (geological).** Land consisting of material unworked by water in recent geologic time and ordinarily lying at a higher elevation than the alluvial plain or stream terrace.

**Undulating.** A relief characterized by successive rolls, or rounded elevations, and depressions.

# Tables

The tables in this soil survey contain information that affects land use planning in this survey area. Current data tables may be available within the Web Soil Survey.

Table 1.—*Approximate acreage and proportionate extent of soils within the high-intensity survey*

| Soil | Area *Acres* | Extent *Percent* |
|---|---|---|
| Anapra silty clay loam | 5,113 | 0.7 |
| Brazito loamy fine sand | 784 | .1 |
| Gila fine sandy loam | 2,731 | .4 |
| Gila loam | 3,320 | .5 |
| Glendale loam | 1,074 | .2 |
| Glendale silty clay loam | 4,546 | .7 |
| Glendale silty clay | 7,953 | 1.2 |
| Harkey loam | 13,234 | 1.9 |
| Harkey silty clay loam | 18,118 | 2.7 |
| Made land, Gila soil material | 6,444 | .9 |
| Saneli silty clay loam | 7,519 | 1.1 |
| Saneli silty clay | 2, 774 | .4 |
| Tigua silty clay | 7, 187 | 1.1 |
| Vinton fine sandy loam | 3, 376 | .5 |
| Total | 84, 173 | 12.4 |

Table 2.—*Approximate acreage and proportionate extent of soils within the low-intensity survey*

| Soil | Area *Acres* | Extent *Percent* |
|---|---|---|
| Agustin association, undulating | 8,887 | 1.3 |
| Badlands | 1,778 | .3 |
| Bluepoint, association, rolling | 95,395 | 14.1 |
| Bluepoint, gravelly association, rolling | 8,888 | 1.3 |
| Delnorte-Canutio association, undulating | 19,552 | 2.9 |
| Delnorte-Canutio association, hilly | 33,733 | 5.0 |
| Dune land. | 12,443 | 1.8 |
| Hueco-Wink association, hummocky | 257,150 | 38.0 |
| Igneous rock land | 1,185 | .2 |
| Igneous rock land-Brewster association | 16,590 | 2.4 |
| Limestone rock land-Lozier association | 40, 291 | 5.9 |
| Lozier association, hilly | 2, 370 | .4 |
| Mimbres association, level | 10, 665 | 1.6 |
| Pajarito association, level | 10, 665 | 1.6 |
| Simona association, undulating | 18,960 | 2.8 |
| Turney-Berino association, undulating | 27,848 | 4.1 |
| Wink association, level | 26,070 | 3.9 |
| Total | 592, 510 | 87. 6 |

Table 3.—*Predicted average yields per acre of the principal crops grown on irrigated soils under improved management*

| Soil | Cotton Upland *Lbs. of lint* | Cotton Pima *Lbs. of lint* | Alfalfa *Tons* |
|---|---|---|---|
| Anapra silty clay loam | 1, 400 | 650 | 7 |
| Brazito loamy fine sand | 750 | 500 | 5 |
| Gila fine sandy loam | 1, 300 | 625 | 7 |
| Gila loam | 1, 400 | 650 | 7 |
| Glendale loam | 1, 500 | 750 | 7 |
| Glendale silty clay | 1, 500 | 700 | 8 |
| Glendale silty clay loam | 1, 500 | 700 | 8 |
| Harkey loam | 1, 500 | 750 | 8 |
| Harkey silty clay loam | 1, 500 | 700 | 8 |
| Pajarito fine sandy loam | 1, 000 | 625 | 6 |
| Saneli silty clay | 1, 500 | 700 | 6 |
| Saneli silty clay loam | 1, 500 | 750 | 5 |
| Tigua silty clay | 1, 500 | 600 | 6 |
| Vinton fine sandy loam | 900 | 550 | 6 |

Note: mapped only in Pajarito association, level.

Table 4.—*Engineering test data (High Intensity)*

[Tests performed by the Texas Highway Department in accordance with standard procedures of the American Association of State Highway Officials (AASHO) (1)]

HIGH-INTENSITY SURVEY

| Soil name and location | Parent material | Report No. THD-67-Tex- | Depth | Lineal shrinkage | Percentage passing sieve[1]— No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | Liquid limit | Plasticity index | Classification AASHO | Unified[2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Glendale silty clay loam: In cultivated field [illegible] (Modal profile) | Recent alluvium. | [illegible] | Inches [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| In cultivated field [illegible] | Recent alluvium. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Harkey silty clay loam: In cultivated field [illegible] (Modal profile) | Recent alluvium. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Harkey loam: In cultivated field [illegible] | Recent alluvium. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Tigua silty clay: In cultivated field [illegible] (Modal profile) | Recent alluvium. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| In cultivated field [illegible] | Recent alluvium. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Vinton fine sandy loam: In cultivated field [illegible] (Modal profile) | Recent alluvium. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

See footnotes at end of table.

Table 4.—*Engineering test data (Low Intensity)*

LOW-INTENSITY SURVEY

| Soil name and location | Parent material | Report No. THD-67-Tex- | Depth | Lineal shrinkage | Percentage passing sieve[1]— No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | Liquid limit | Plasticity index | Classification AASHO | Unified[2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Berino fine sandy loam: In pasture [illegible] (Modal profile) | Intermountain basin deposits. | [illegible] | Inches [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| In pasture [illegible] | Intermountain basin deposits. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Delnorte very gravelly loam: In pasture [illegible] (Modal profile) | Intermountain basin deposits. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Delnorte stony loam: In pasture [illegible] (Modal profile) | Intermountain basin deposits. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Hueco loamy fine sand: In pasture [illegible] (Modal profile) | Intermountain basin deposits. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| In pasture [illegible] | Intermountain basin deposits. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Turney fine sandy loam: In pasture [illegible] (Modal profile) | Intermountain basin deposits. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| In pasture [illegible] | Intermountain basin deposits. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Wink fine sandy loam: In pasture [illegible] (Modal profile) | Intermountain basin deposits. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| In pasture [illegible] | Intermountain basin deposits. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

[illegible]

Table 5.—*Estimated engineering properties of the soils (High Intensity)*

[Dashed lines indicate that properties were not estimated. Badlands; Igneous rock land; Limestone rock land; and Made land, Gila soil material, are not listed in the table. These land types are too variable to be rated or are not suitable for engineering uses]

HIGH-INTENSITY SURVEY

| Soils and map symbols | Depth from surface | Classification: USDA texture | Classification: Unified | Classification—Continued: AASHO | Percentage passing sieve—: No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | Permeability | Available water capacity | Shrink-swell potential |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Inches* | | | | | | | | *Inches per hour* | *Inches per inch of soil* | |
| Anapra: An | 0-23 | Silty clay loam | CL | A-6 or A-7 | 100 | 100 | 95-100 | 60-85 | 0.06-0.20 | 0.17 | Moderate. |
| | 23-60 | Fine sand | SM or SM-SC | A-2-4 or A-4 | 100 | 100 | 85-95 | 20-30 | 6.30-20.00 | .05 | Low. |
| Brazito: Br | 0-10 | Loamy fine sand | SM | A-2-4 or A-4 | 100 | 100 | 70-85 | 25-40 | 2.00-6.30 | .08 | Low. |
| | 10-60 | Fine sand | SP-SM or SM | A-2-4 or A-3 | 100 | 100 | 85-98 | 5-15 | 6.30-20.00 | .05 | Low. |
| Gila: | | | | | | | | | | | |
| Ga | 0-20 | Fine sandy loam | SM-SC or ML-CL | A-4 | 100 | 100 | 70-85 | 40-55 | 0.63-2.00 | .12 | Low. |
| | 20-60 | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1). |
| Gc | 0-17 | Loam | ML or CL | A-4 or A-6 | 100 | 100 | 85-95 | 60-75 | 0.63-2.00 | .15 | Low to moderate. |
| | 17-60 | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1). |
| Glendale: | | | | | | | | | | | |
| Gd | 0-19 | Loam | ML or CL | A-4 or A-6 | 100 | 100 | 85-95 | 60-75 | 0.20-0.63 | .15 | Low to moderate. |
| | 19-40 | Silty clay loam | CL | A-7 or A-6 | 100 | 100 | 95-100 | 80-95 | 0.06-0.20 | .17 | Moderate. |
| | 40-60 | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1). |
| Ge | 0-33 | Silty clay loam | CL | A-6 or A-7 | 100 | 100 | 95-100 | 80-95 | 0.06-0.20 | .17 | Moderate. |
| | 33-60 | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1). |
| Gs | 0-16 | Silty clay | CH | A-7 | 100 | 100 | 95-100 | 90-95 | 0.06 | .18 | High. |
| | 16-40 | Silty clay loam | CL | A-7 or A-6 | 100 | 100 | 95-100 | 80-95 | 0.06-0.20 | .17 | Moderate. |
| | 40-60 | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1). |
| Harkey: | | | | | | | | | | | |
| Hk | 0-17 | Loam | ML or CL | A-4 or A-6 | 100 | 100 | 85-95 | 60-85 | 0.20-0.63 | .15 | Low to moderate. |
| | 17-60 | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1). |
| Hs | 0-17 | Silty clay loam | CL | A-6 | 100 | 100 | 95-100 | 50-85 | 0.06-0.20 | .17 | Moderate. |
| | 17-60 | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1). |
| Saneli: | | | | | | | | | | | |
| Se | 0-19 | Silty clay loam | CL | A-7 or A-6 | 100 | 100 | 95-100 | 85-95 | 0.06-0.20 | .17 | Moderate. |
| | 19-34 | Clay | CH | A-7 | 100 | 100 | 95-100 | 90-95 | 0.06 | .18 | High. |
| | 34-60 | Loamy fine sand | SM-SC or SP-SM | A-2, A-3, or A-4 | 100 | 100 | 70-85 | 10-30 | 2.00-6.30 | .08 | Low. |
| Ss | 0-12 | Silty clay | CH | A-7 | 100 | 100 | 95-100 | 90-95 | 0.06 | .18 | High. |
| | 12-32 | Clay | CH | A-7 | 100 | 100 | 95-100 | 90-95 | 0.06 | .18 | High. |
| | 32-60 | Fine sand | SP-SM or SM | A-2-4 or A-3 | 100 | 100 | 80-90 | 5-15 | 6.30-20.0 | .05 | Low. |
| Tigua: Tg | 0-10 | Silty clay | CH | A-7 | 100 | 100 | 95-100 | 90-100 | 0.06 | .18 | High. |
| | 10-50 | Clay | CH | A-7 | 100 | 100 | 95-100 | 90-100 | 0.06 | .18 | High. |
| | 50-60 | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1). |
| Vinton: Vn | 0-12 | Fine sandy loam | SM-SC or ML-CL | A-4 | 100 | 100 | 95-100 | 45-60 | 0.63-2.00 | .10 | Low. |
| | 12-60 | Loamy fine sand | SP-SM or SM-SC | A-2 or A-4 | 100 | 100 | 95-100 | 10-30 | 2.00-6.30 | .08 | Low. |

See footnotes at end of table.

Table 5.—*Estimated engineering properties of the soils (Low Intensity)*

LOW-INTENSITY SURVEY[2]

| Soils and map symbols | Depth from surface | Classification: USDA texture | Classification: Unified | Classification—Continued: AASHO | Percentage passing sieve—: No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | Permeability | Available water capacity | Shrink-swell potential |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Inches* | | | | | | | | *Inches per hour* | *Inches per inch of soil* | |
| Agustin: AGB | 0-60 | Gravelly loam | GM or SM | A-4 or A-2-4 | 55-80 | 40-70 | 35-65 | 30-50 | 0.63-2.00 | 0.10 | Low. |
| Berino[2] (Mapped only with Turney soils.) | 0-8 | Fine sandy loam | SM or SM-SC | A-2 or A-4 | 100 | 100 | 90-100 | 25-45 | 0.63-2.00 | .10 | Low. |
| | 8-12 | Loam | CL | A-6 | 100 | 100 | 85-95 | 60-75 | 0.63-2.00 | .15 | Moderate. |
| | 12-27 | Clay loam | CL | A-6 | 100 | 95-100 | 85-95 | 55-70 | 0.20-0.63 | .18 | Moderate. |
| | 27-62 | Loam | SC or CL | A-6 | 90-100 | 85-95 | 60-75 | 45-65 | 0.63-2.00 | .15 | Low to moderate. |
| | 62-100 | Fine sandy loam | SM or SM-SC | A-2 or A-4 | 100 | 100 | 90-100 | 25-45 | 0.63-2.00 | .10 | Low. |
| Bluepoint: | | | | | | | | | | | |
| BPC | 0-60 | Loamy fine sand | SM | A-2-4 | 100 | 95-100 | 70-85 | 10-25 | 6.30-20.00 | .06 | Low. |
| BGC | 0-12 | Gravelly sand | SP-SM or SM | A-1, A-2, or A-3 | 85-95 | 60-75 | 40-65 | 5-12 | 6.30-20.00 | .05 | Low. |
| | 12-60 | Fine sand | SP-SM or SM | A-2 or A-3 | 100 | 100 | 85-98 | 5-12 | 6.30-20.00 | .05 | Low. |
| Brewster: IS (Properties of Igneous rock land in IS were not estimated.) | 0-10 | Stony loam | GC | A-1 or A-2 | 20-50 | 20-50 | 20-40 | 15-35 | 0.63-2.00 | .12 | Low. |
| | 10 | Igneous rock. | | | | | | | | | |
| Canutio[2] (Mapped only with Delnorte soils.) | 0-45 | Very gravelly sandy loam | GM | A-1 | 40-50 | 25-45 | 20-40 | 10-20 | 2.00-6.30 | .05 | Low. |
| Delnorte: DCB, DCD (For properties of Canutio soils in these associations see the Canutio series.) | 0-8 | Very gravelly loam | SC-SM, SC, or GM-GC | A-2 or A-4 | 60-85 | 40-75 | 35-70 | 20-45 | 2.00-6.30 | .10 | Low. |
| | 8-10 | Indurated caliche. | | | | | | | | | |
| Dune land: DU | 0-60 | Sand | SP | A-3 | 100 | 100 | 65-80 | 0-5 | >20.00 | .03-.05 | Low. |
| Hueco: HW (For properties of Wink soils in this association see the Wink series.) | 0-4 | Loamy fine sand | SP or SP-SM | A-2 | 100 | 100 | 70-85 | 5-10 | 2.00-6.30 | .06 | Low. |
| | 4-20 | Fine sandy loam | SM or SM-SC | A-2-4 | 100 | 100 | 80-95 | 15-30 | 2.00-6.30 | .10 | Low. |
| | 20-30 | Indurated caliche. | | | | | | | | | |
| Lozier: LM, LCG (Properties of Limestone rock land in LM were not estimated.) | 0-5 | Stony loam | GM | A-1 or A-2 | 20-50 | 20-50 | 20-40 | 15-35 | 0.63-2.00 | .10 | Low. |
| | 5 | Limestone. | | | | | | | | | |
| Mimbres: MSA[3] | 0-20 | Silt loam | ML | A-4 | 100 | 100 | 90-100 | 70-90 | 0.20-0.63 | .18 | Low. |
| | 20-60 | Loam | ML or CL | A-4 or A-6 | 100 | 100 | 85-95 | 60-75 | 0.63-2.00 | .14 | Low to moderate. |
| Pajarito: PAA | 0-60 | Fine sandy loam | SM or SM-SC | A-2-4 or A-4 | 100 | 100 | 80-100 | 25-45 | 0.63-2.00 | .10 | Low. |
| Simona: SMB | 0-16 | Gravelly fine sandy loam | GM or SM | A-4 or A-2-4 | 55-85 | 40-70 | 35-65 | 20-40 | 0.63-2.00 | .08 | Low. |
| | 16-60 | Indurated caliche. | | | | | | | | | |
| Turney: TUC (For properties of Berino soils in this association, see the Berino series.) | 0-5 | Fine sandy loam | SM or SM-SC | A-2 or A-4 | 100 | 100 | 90-100 | 25-45 | 0.63-2.00 | .10 | Low. |
| | 5-10 | Loam | CL | A-6 | 100 | 95-100 | 85-95 | 50-65 | 0.63-2.00 | .15 | Moderate. |
| | 10-34 | Clay loam | CL | A-6 | 100 | 95-100 | 75-90 | 55-70 | 0.20-0.63 | .16 | Moderate. |
| | 34-60 | Caliche cement clay loam (variable). | CL | A-6 | 95-100 | 95-100 | 75-90 | 55-70 | 0.20-0.63 | .12 | Moderate. |
| | 60-80 | Fine sandy loam | SM or SM-SC | A-2 or A-4 | 100 | 100 | 80-100 | 25-45 | 0.63-2.00 | .10 | Low. |
| Wink: WKA | 0-24 | Fine sandy loam | SM-SC | A-2-4 | 100 | 95-100 | 85-100 | 20-35 | 0.63-2.00 | .10 | Low. |
| | 24-73 | Cemented caliche. | | | | | | | | | |
| | 73-100 | Gravelly loam | SM or SM-SC | A-2 or A-4 | 80-95 | 70-85 | 65-80 | 25-45 | 2.00-6.30 | .08 | Low. |

[1] Variable.
[2] The composition of these mapping units is more variable than that of other units in the county, but it has been controlled well enough to interpret for the expected use of the soils concerned.
[3] Soils are subject to flooding.

Table 6.—*Engineering interpretations of soils within the high-intensity survey*

| Soils and map symbols | Suitability as source of— Topsoil | Sand and gravel | Road fill | Soil features affecting— Highway location | Dike and levees | Agricultural drainage | Irrigation | Diversions |
|---|---|---|---|---|---|---|---|---|
| Anapra: An | Good to depth of about 24 inches, poor below that depth. | Poor: 24 inches deep to sand; contains 30 to 50 percent fines. | Poor in uppermost 24 inches: moderate shrink-swell potential; good to fair below 24 inches. | Medium plasticity | Moderate shrink-swell potential in uppermost 24 inches; poor to very poor resistance to piping below 24 inches. | Slow permeability in surface layer; rapid permeability below 24 inches. | Slow intake rate; moderately deep root zone. | Soil features favorable. |
| Brazito: Br | Poor: very low fertility and available moisture capacity; severe hazard of soil blowing. | Fair: contains 5 to 15 percent fines; poorly graded. | Good: soil binder may be needed. | Severe hazard of soil blowing. | Poor resistance to piping | Rapid permeability; ditch banks unstable. | Rapid intake rate; very low available moisture capacity. | Severe hazard of soil blowing. |
| Gila: Ga, Gc | Fair: moderate hazard of soil blowing. | Unsuitable | Fair: low to moderate shrink-swell potential. | Moderate hazard of soil blowing. | Poor resistance to piping; poor stability. | Moderate permeability; ditch banks unstable. | Soil features favorable | Moderate hazard of soil blowing. |
| Glendale: Gd, Ge, Gn | Good | Unsuitable | Poor: low bearing strength; moderate to high shrink-swell potential. | Medium plasticity; moderate shrink-swell potential. | Moderate to high shrink-swell potential. | Slow permeability in surface layer, moderate permeability in underlying material. | Slow permeability in surface layer. | Soil features favorable. |
| Harkey: Ha, Hk | Good | Unsuitable | Poor to fair: low to moderate shrink-swell potential; contains layers of highly plastic material in some areas. | Moderate shrink-swell potential to a depth of 20 inches in some areas. | Low to moderate shrink-swell potential. | Moderately slow permeability. | Soil features favorable | Soil features favorable. |
| Made land, Gila soil material: Mg | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1). |
| Saneli: Sa, Sn | Poor: high clay content. | Poor: fine sand under a 22-inch layer of clay; contains 5 to 15 percent fines. | Poor in clay to a depth of 22 inches; high shrink-swell potential and low bearing strength; good in sand below 22 inches. | High shrink-swell potential; high plasticity. | High shrink-swell potential and high cracking hazard to a depth of 22 inches; poor resistance to piping in sand below 22 inches. | Very slow permeability to depth of 22 inches; rapid permeability in sand below 22 inches. | Very slow intake rate; moderately deep root zone. | Surface layer is subject to cracking and has high plasticity. |
| Tigua: Tg | Poor: high clay content. | Unsuitable | Poor: high shrink-swell potential; low shear strength; highly plastic. | High shrink-swell potential; high plasticity. | High shrink-swell potential and high cracking hazard. | Very slow permeability in surface layer, moderate permeability in underlying material. | Very slow intake rate; subject to build up of salinity. | High shrink-swell potential; high plasticity. |
| Vinton: Vn | Poor: low fertility and available moisture capacity; severe hazard of soil blowing. | Fair: 10 to 50 percent fines; poorly graded. | Good | Severe hazard of soil blowing. | Fair to poor resistance to piping; fair to poor stability. | Rapid permeability; ditch banks unstable. | Moderately rapid intake rate; low available moisture capacity. | Severe hazard of soil blowing; poor stability. |

[1] Material is so variable that interpretations were not made.

Table 7.—*Engineering interpretations of soils within the low-intensity survey*

| Soils and map symbols | Suitability as source of— Topsoil | Sand and gravel | Road fill | Soil features affecting— Highway location | Soil features affecting—Continued Dikes and levees | Farm ponds: Reservoir areas | Farm ponds: Embankments | Diversions | Irrigation |
|---|---|---|---|---|---|---|---|---|---|
| Agustin: AGB | Poor: contains 15 to 35 percent gravel. | Poor: gravel contains 30 to 50 percent fines. | Fair to good | Soil features favorable | Poor resistance to piping. | Moderate permeability | Poor resistance to piping; moderate permeability. | Fair stability | Moderate intake rate; low available moisture capacity. |
| Badlands: BA | Poor: very low productivity; high clay content. | Unsuitable | Very poor: high shrink-swell potential; poor workability; highly plastic. | High shrink-swell potential; high plasticity. | High shrink-swell potential; high cracking hazard. | Soil features favorable | Clayey material; high shrink-swell potential; poor compaction and stability. | Fair to poor stability; steep slopes. | Steep slopes; low productivity; impervious clay. |
| Berino (Mapped only with Turney soils.) | Good | Unsuitable | Poor: moderate shrink-swell potential; contains plastic layers. | Subject to flooding; moderate shrink-swell potential. | Moderate shrink-swell potential; fair stability. | Moderate permeability in substratum. | Moderate shrink-swell potential; fair stability. | Subject to excessive silting. | Subject to flooding; moderately slow permeability; high available moisture capacity. |
| Bluepoint: BPC | Poor: low productivity; hazard of soil blowing. | Fair: poorly graded; contains 20 to 25 percent fines. | Good | Severe hazard of soil blowing; rolling relief. | Poor resistance to piping. | Rapid permeability | Poor resistance to piping. | Severe hazard of soil blowing; rapid permeability. | Complex slopes; severe hazard of soil blowing; low available moisture capacity; rapid permeability. |
| BUC | Poor: low productivity | Good: contains 10 to 15 percent fines; contains some gravel. | Good | Rolling relief | Poor resistance to piping. | Rapid permeability | Poor resistance to piping. | Complex slopes; rapid permeability. | Complex slopes; very low available moisture capacity; rapid permeability. |
| Brewster (Mapped only with Igneous rock land.) | Poor: contains more than 35 percent stone fragments; bedrock typically at depth of 10 inches. | Unsuitable: bedrock typically at depth of 10 inches. | Unsuitable: material at source less than 1 foot thick. | Steep slopes; bedrock typically at depth of 10 inches. | Bedrock typically at depth of 10 inches; soil material contains large stones. | Bedrock typically at depth of 10 inches; very steep slopes. | Limited volume of soil material; many stones and cobblestones. | Bedrock typically at depth of 10 inches, steep slopes. | Very shallow soil; many stones and cobblestones; steep slopes. |
| Canutio (Mapped only with Delnorte soils.) | Poor: contains more than 20 percent gravel, cobblestones, and stones. | Fair: contains 10 to 20 percent fines; stones and cobblestones present. | Good | Subject to frequent flooding. | Poor resistance to piping. | Moderately rapid permeability. | Poor resistance to piping; moderate permeability. | Fair stability | Subject to frequent flooding; very high content of stones, cobblestones, and gravel; very low fertility and available moisture capacity. |
| Delnorte: DCB, DCD (For interpretations of Canutio soils in these associations, see the Canutio series.) | Poor: contains 15 to 35 percent gravel; indurated caliche at depth of 8 inches. | Fair below the indurated caliche: poorly graded gravel and sand. | Unsuitable: very shallow to indurated caliche. | Indurated caliche at depth of less than 20 inches. | Very shallow to indurated caliche. | Very shallow to indurated caliche. | Fair stability; limited volume of soil material. | Very shallow to indurated caliche. | Gravelly soil; very shallow over indurated caliche; steep slopes; very low available moisture capacity. |
| Dune land: DU | Poor: severe hazard of soil blowing; very low fertility; very low available moisture capacity. | Fair: poorly graded sand; less than 5 percent fines. | Good if confined or if soil binder is added. | Severe hazard of soil blowing; loose sand hinders hauling. | Poor resistance to piping; poor stability. | Very rapid permeability and seepage rate. | Poor resistance to piping; very rapid permeability; poor stability. | Severe hazard of soil blowing. | Severe hazard of soil blowing; very low available water capacity; very rapid intake rate. |
| Hueco: HW (For interpretations of Wink soils in this association, see the Wink series.) | Poor: severe hazard of soil blowing; low available moisture capacity. | Fair: poorly graded sand; good source of caliche for crushing. | Fair: material at source 2 to 3 feet thick. | Severe hazard of soil blowing. | Fair to poor resistance to piping; fair to poor stability. | Indurated caliche at depth of 2 to 3 feet. | Fair to poor resistance to piping; moderate permeability; fair to poor stability. | Indurated caliche at depth of 2 to 3 feet; severe hazard of soil blowing. | Moderately rapid intake rate; low available moisture capacity. |
| Igneous rock land: IG, IR (For interpretations of Brewster soils in IR association, see the Brewster series.) | Unsuitable: exposed igneous bedrock. | Unsuitable | Unsuitable: exposed igneous bedrock. | Steep slopes; exposed igneous bedrock. | Exposed igneous bedrock. | Exposed igneous bedrock; slopes greater than 20 percent. | Exposed igneous bedrock. | Exposed igneous bedrock; slopes greater than 20 percent. | Exposed igneous bedrock; slopes greater than 20 percent. |

Table 8.—*Soil limitations affecting selected uses in community development within the high-intensity survey*

| Soil and map symbol | Degree and kind of limitations for septic tank filter fields | Soil features affecting— | Soil features affecting—Continued | | | |
|---|---|---|---|---|---|---|
| | | Foundations for buildings of three stories or less | Trafficways | Intensive play areas | Parks or recreational areas | Trafficability |
| Anapra silty clay loam: An | Slight | Moderate shrink-swell potential | Moderate shrink-swell potential; fair traffic-supporting capacity. | Fair surface stability | Moderate surface stability | Soil features favorable. |
| Brazito loamy fine sand: Br | Slight | Soil features favorable | Soil features favorable | Severe hazard of soil blowing | Severe hazard of soil blowing | Loose sand. |
| Gila fine sandy loam: Ga | Slight | Soil features favorable | Soil features favorable | Moderate hazard of soil blowing | Moderate hazard of soil blowing | Soil features favorable. |
| Gila loam: Gl | Slight | Soil features favorable | Soil features favorable | Soil features favorable | Soil features favorable | Soil features favorable. |
| Glendale loam: Gd | Moderate: slow permeability | Moderate shrink-swell potential | Soil features favorable | Soil features favorable | Soil features favorable | Soil features favorable. |
| Glendale silty clay loam: Ge | Moderate: slow permeability | Moderate shrink-swell potential | Moderate shrink-swell potential. | Fair surface stability | Fair surface stability | Soil features favorable. |
| Glendale silty clay: Gs | Moderate: slow permeability | High shrink-swell potential in surface layer | High shrink-swell potential | Poor surface stability; surface cracks when dry. | Poor surface stability; surface cracks when dry. | High shrink-swell potential. |
| Harkey loam: Ha | Slight | Low to moderate shrink-swell potential | Soil features favorable | Soil features favorable | Soil features favorable | Soil features favorable. |
| Harkey silty clay loam: Hk | Slight | Low to moderate shrink-swell potential | Moderate shrink-swell potential in surface layer. | Fair surface stability | Fair surface stability | Soil features favorable. |
| Made land, Gila soil material: Mg | Slight | Soil features favorable | Soil features favorable | Soil features favorable | Soil features favorable | Highly variable. |
| Saneli silty clay loam: Sa | Severe: permeability very slow in upper part, rapid in lower part. | High shrink-swell potential | High shrink-swell potential | Fair surface stability | Fair surface stability | Soil features favorable. |
| Saneli silty clay: Se | Severe: permeability very slow in upper part, rapid in lower part. | High shrink-swell potential | High shrink-swell potential | Fair surface stability | Fair surface stability | High shrink-swell potential. |
| Tigua silty clay: Tg | Severe: very slow permeability | High shrink-swell potential | High shrink-swell potential | Poor surface stability; surface cracks when dry. | Poor surface stability; surface cracks when dry. | High shrink-swell potential. |
| Vinton fine sandy loam: Vn | Slight | Soil features favorable | Soil features favorable | Soil features favorable | Soil features favorable | Hazard of soil blowing. |

Table 9.—*Soil limitations affecting selected uses in community development within the low-intensity survey*

| Dominant soil and map symbol | Degree and kind of limitations for septic tank filter fields | Soil features affecting— | Soil features affecting—Continued | | | |
|---|---|---|---|---|---|---|
| | | Foundations for buildings of 3 stories or less | Trafficways | Intensive play areas | Parks or recreational areas | Trafficability |
| Agustin gravelly loam: AGB | Slight | Soil features favorable | Soil features favorable | More than 15 percent coarse fragments. | Soil features favorable | Hazard of water erosion. |
| Badlands: BA | Severe: slow or very slow permeability; steep slopes. | High shrink-swell potential | High shrink-swell potential; steep slopes. | Steep slopes; clay texture | Steep slopes; clay texture | Steep slopes; erodible. |
| Betton fine sandy loam (Mapped only in an association with Turney soils.) | Severe: hazard of flooding | Hazard of flooding | Hazard of flooding | Hazard of flooding | Hazard of flooding | Hazard of flooding. |
| Bluepoint loamy fine sand: BPC | Slight | Soil features favorable | Soil features favorable | Sand subject to blowing; complex slopes. | Sand subject to blowing | Loose sand. |
| Bluepoint gravelly sand: BUC | Slight | Soil features favorable | Soil features favorable | More than 15 percent coarse fragments; complex slopes. | Soil features favorable | Gravelly sand; complex slopes. |
| Brewster stony loam (Mapped only in an association with Igneous rock land.) | Severe: bedrock less than 10 inches below surface; steep slopes. | Steep slopes; bedrock less than 10 inches below surface. | Bedrock less than 10 inches below surface; steep slopes. | Steep slopes; stones | Steep slopes; stones | Steep slopes; stones. |
| Canutio very gravelly sandy loam (Mapped only in association with Delnorte soils.) | Severe: hazard of flooding | Hazard of flooding | Hazard of flooding | Hazard of flooding; coarse fragments. | Hazard of flooding; coarse fragments. | Severe hazard of flooding; gullied. |
| Delnorte very gravelly loam: DCB, DCD (For limitations of Canutio very gravelly sandy loam in associations DCB and DCD, see the Canutio soil.) | Severe: less than 10 inches to indurated caliche. | Complex slopes; less than 10 inches to indurated caliche. | Complex slopes; less than 10 inches to indurated caliche. | Slopes; coarse fragments | Complex slopes; coarse fragments. | Complex slopes; severe hazard of water erosion. |
| Dune land: DU | Slight | Severe hazard of blowing | Severe hazard of blowing | Severe hazard of blowing | Severe hazard of blowing | Loose, shifting sand. |
| Hueco loamy fine sand: HW (For limitations of Wink fine sandy loam in association HW, see the Wink soil.) | Severe: 40 inches or less to indurated caliche. | Depth to indurated caliche 20 to 40 inches. | Depth to indurated caliche 20 to 40 inches; hazard of soil blowing. | Sandy surface layer subject to blowing. | Sandy surface layer subject to blowing. | Sandy surface layer. |
| Igneous rock land: IG, IN (For limitations of Brewster stony loam in association IN, see the Brewster soil.) | Very severe: steep slopes; exposed bedrock. | Steep slopes; exposed bedrock | Steep slopes; exposed bedrock | Steep slopes; exposed bedrock | Steep slopes; exposed bedrock | Steep slopes; exposed bedrock. |
| Limestone rock land: LM (For limitations of Lozier stony loam in association LM, see the Lozier soil.) | Very severe: steep slopes; exposed bedrock. | Steep slopes; exposed bedrock | Steep slopes; exposed bedrock | Steep slopes; exposed bedrock | Steep slopes; exposed bedrock | Steep slopes; exposed bedrock. |
| Lozier stony loam: LOD | Severe: bedrock at depth of less than 10 inches; complex slopes. | Complex slopes; bedrock at depth of less than 10 inches. | Complex slopes; bedrock at depth of less than 10 inches. | Complex slopes; bedrock at depth of less than 10 inches; stones. | Complex slopes; stones | Complex slopes; bedrock at depth of less than 10 inches; stones. |
| Mimbres loam: MBA | Severe: hazard of flooding | Hazard of flooding | Hazard of flooding | Hazard of flooding | Hazard of flooding | Hazard of flooding. |
| Pajarito fine sandy loam: PAA | Slight | Soil features favorable | Soil features favorable | Soil features favorable | Soil features favorable | Soil features favorable. |
| Simona gravelly loam: SMB | Severe: 8 to 20 inches to indurated caliche. | 8 to 20 inches to indurated caliche | 8 to 20 inches to indurated caliche. | More than 15 percent coarse fragments. | Soil features favorable | Hazard of water erosion. |
| Turney fine sandy loam: TBB (For limitations of Betton fine sandy loam in association TBB, see the Betton soil.) | Slight | Soil features favorable | Soil features favorable | Soil features favorable | Soil features favorable | Soil features favorable. |
| Wink fine sandy loam: WKA | Moderate: 20 to 40 inches to hard caliche. | 20 to 40 inches to hard caliche | Soil features favorable | Gently sloping to plane | Soil features favorable | Hazard of water erosion. |

Table 10.—*Soil series classified according to the present system of classification*

| Series | Family | Subgroup | Order |
|---|---|---|---|
| Agustin | Coarse-loamy, mixed, thermic | Typic Camborthids | Aridisols. |
| Anapra | Fine-silty over sandy, mixed, calcareous, thermic | Typic Torrifluvents | Entisols. |
| Berino | Fine-loamy, mixed, thermic | Typic Haplargids | Aridisols. |
| Bluepoint | Mixed, thermic | Typic Torripsamments | Entisols. |
| Brazito | Mixed, thermic | Typic Torripsamments | Entisols. |
| Brewster | Loamy-skeletal, mixed, thermic | Aridic Lithic Haplustolls | Mollisols. |
| Canutio | Loamy-skeletal, mixed, calcareous, thermic | Typic Torriorthents | Entisols. |
| Delnorte | Loamy-skeletal, mixed, thermic, shallow | Typic Paleorthids | Aridisols. |
| Gila | Coarse-loamy, mixed, calcareous, thermic | Typic Torrifluvents | Entisols. |
| Glendale | Fine-silty, mixed, calcareous, thermic | Typic Torrifluvents | Entisols. |
| Harkey | Coarse-silty, mixed, calcareous, thermic | Typic Torrifluvents | Entisols. |
| Hueco | Coarse-loamy, mixed, thermic | Petrocalcic Paleargids | Aridisols. |
| Lozier | Loamy-skeletal, carbonatic, thermic | Lithic Torriorthents | Entisols. |
| Mimbres | Fine-silty, mixed, thermic | Typic Camborthids | Aridisols. |
| Pajarito | Coarse-loamy, mixed, thermic | Typic Camborthids | Aridisols. |
| Saneli | Clayey over sandy or sandy-skeletal, montmorillonitic, calcareous, thermic. | Vertic Torrifluvents | Entisols. |
| Simona | Loamy, mixed, thermic, shallow | Typic Paleorthids | Aridisols. |
| Tigua | Very fine, montmorillonitic, calcareous, thermic | Vertic Torrifluvents | Entisols. |
| Turney | Fine-loamy, mixed, thermic | Typic Calciorthids | Aridisols. |
| Vinton | Sandy, mixed, thermic | Typic Torrifluvents | Entisols. |
| Wink | Coarse-loamy, mixed, thermic | Typic Calciorthids | Aridisols. |

Table 11.—*Temperature and precipitation, El Paso County, Texas*

[Elevation at weather station about 3,900 feet]

| Month | Temperature (° F.) | | | | | | | Heating degree-days | Average number of days with—Maximum temperature of— | | Average number of days with—Minimum temperature of— | | Precipitation | | | | | | | | | | Snow, sleet | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average daily maximum | Average daily minimum | Average monthly | Record high Degrees | Record high Year | Record low Degrees | Record low Year | | 90° and above | 32° and below | 32° and below | Zero and below | Driest year | Wettest year | Average | Greatest daily Inches | Greatest daily Year | Probability of receiving—Trace or less | Probability of receiving—0.50 inch or more | Average number of days with—0.10 inch or more | Average number of days with—0.50 inch or more | Average number of days with—1.00 inch or more | Average | Greatest monthly Inches | Greatest monthly Year |
| January | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| February | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| March | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| April | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| May | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| June | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| July | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| August | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| September | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| October | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| November | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| December | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Year | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

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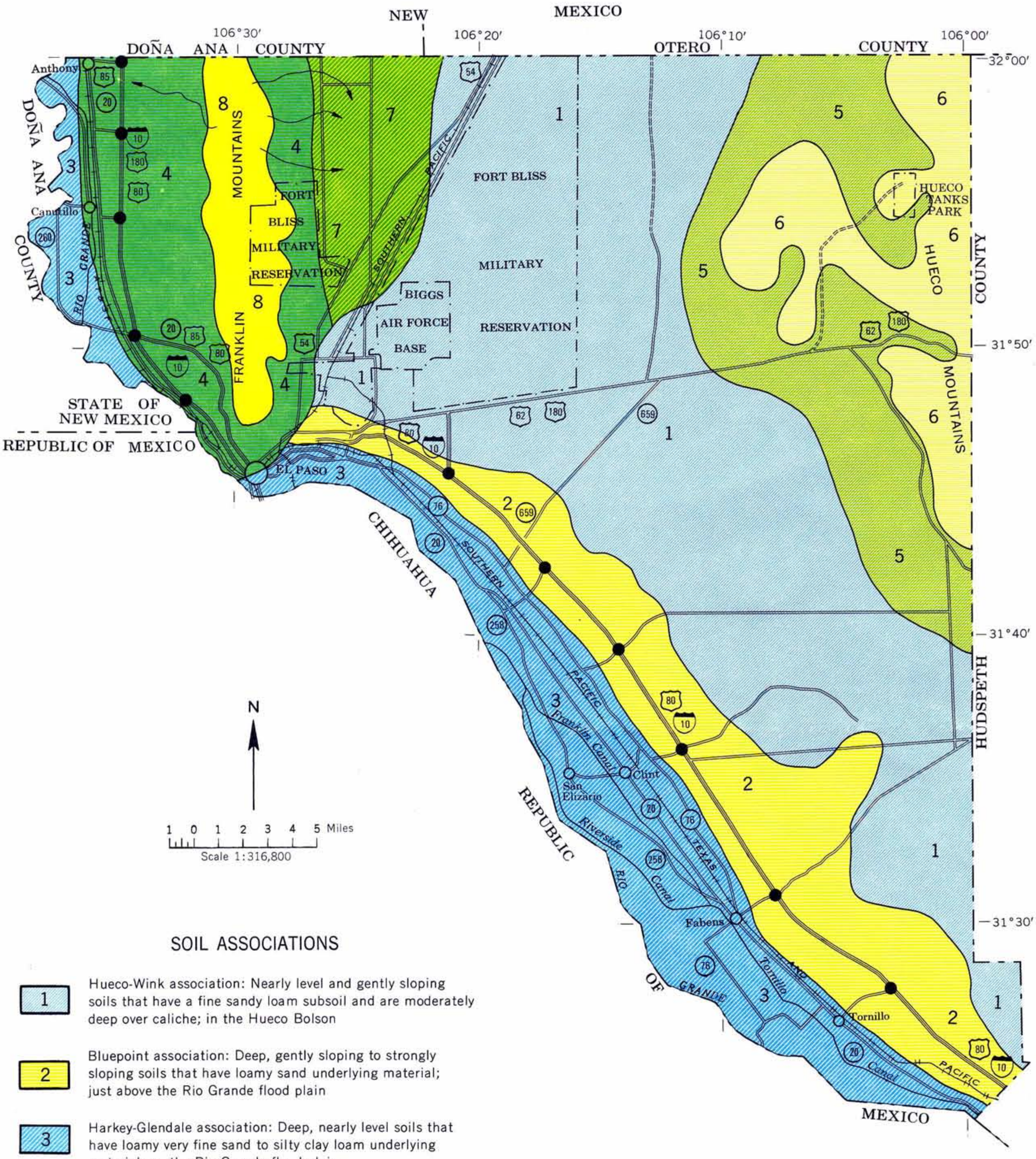
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TEXAS AGRICULTURAL EXPERIMENT STATION

# GENERAL SOIL MAP

## EL PASO COUNTY, TEXAS




## SOIL ASSOCIATIONS

1 Hueco-Wink association: Nearly level and gently sloping soils that have a fine sandy loam subsoil and are moderately deep over caliche; in the Hueco Bolson

2 Bluepoint association: Deep, gently sloping to strongly sloping soils that have loamy sand underlying material; just above the Rio Grande flood plain

3 Harkey-Glendale association: Deep, nearly level soils that have loamy very fine sand to silty clay loam underlying material; on the Rio Grande flood plain

4 Delnorte-Canutio association: Nearly level to steep soils that are shallow or very shallow over caliche or that are deep and gravelly throughout; mainly on and near foot slopes of the Franklin Mountains

5 Wink-Simona-Mimbres association: Nearly level to sloping soils that are moderately deep or shallow over hard caliche or that are deep and have a silt loam subsoil; mainly on alluvial fans and foot slopes of the Hueco Mountains

6 Limestone rock land-Lozier association: Steep and very steep, rocky areas and very shallow, stony soils; in the Hueco Mountains

7 Turney-Berino association: Nearly level and gently sloping soils that have a clay loam subsoil and are moderately deep over soft caliche; in the Hueco Bolson

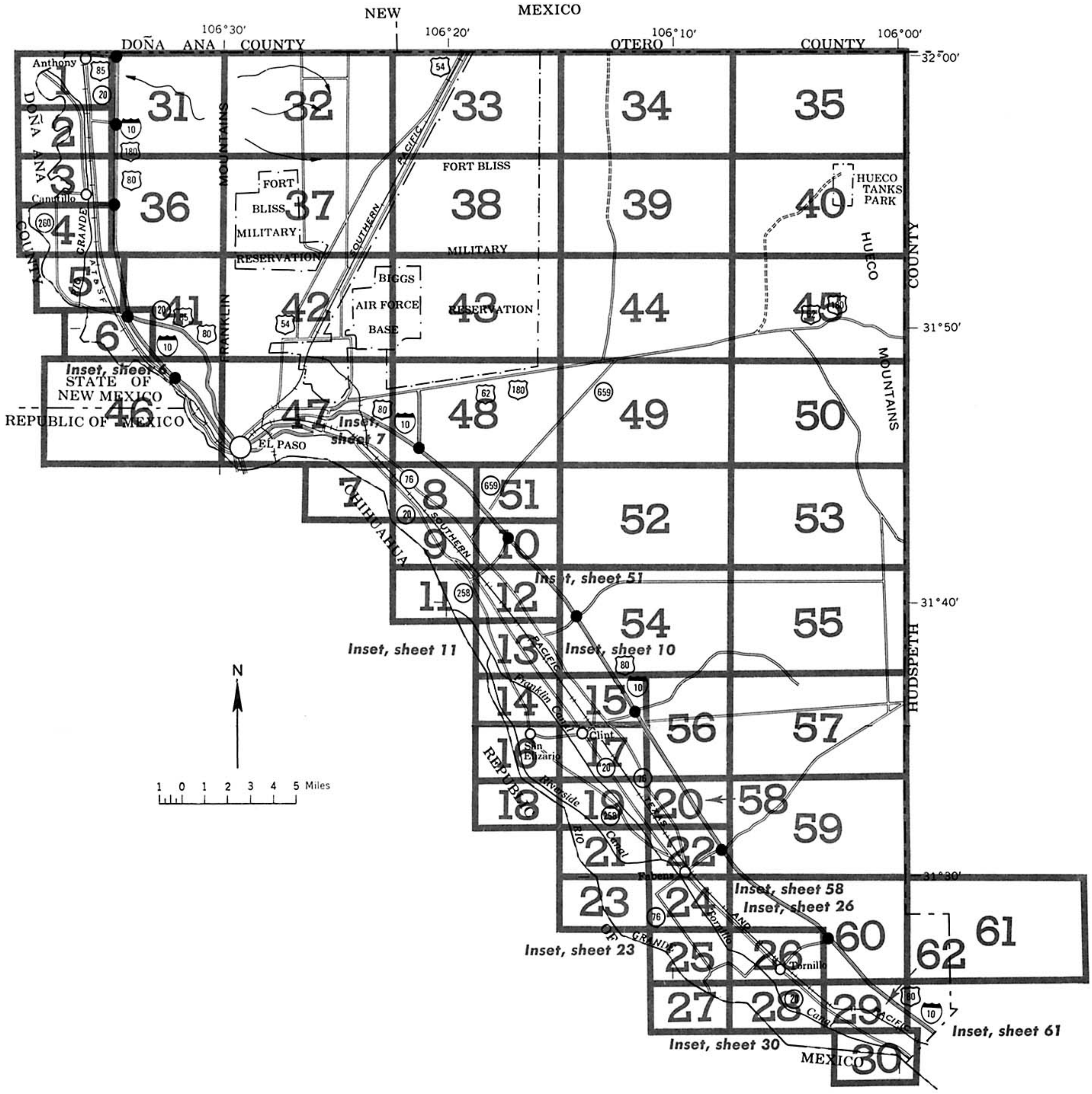
8 Igneous rock land-Limestone rock land association: Very steep areas of igneous and limestone rocks and stony soils; in the Franklin Mountains

*This map is for general planning. It shows only the major soils and does not contain sufficient detail for operational planning.*

Published 1971

## INDEX TO MAP SHEETS

EL PASO COUNTY, TEXAS



## SOIL LEGEND

The first capital letter is the initial one of the soil name. The second letter is a capital if the mapping unit is one of the low intensity survey; otherwise it is a small letter. The third letter, always a capital A, B, C, or D, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. (W) following the soil name indicates that erosion, especially that caused by blowing, is evident in places, but the degree cannot be estimated reliably.

### HIGH INTENSITY

| SYMBOL | NAME |
|---|---|
| An | Anapra silty clay loam |
| Br | Brazito loamy fine sand (W) |
| Ga | Gila fine sandy loam (W) |
| Gc | Gila loam |
| Gd | Glendale loam |
| Ge | Glendale silty clay loam |
| Gs | Glendale silty clay |
| Ho | Harkey loam |
| Hk | Harkey silty clay loam |
| Mg | Made land, Gila soil material |
| Sa | Saneli silty clay loam |
| Sc | Saneli silty clay |
| Tg | Tigua silty clay |
| Vn | Vinton fine sandy loam (W) |

### LOW INTENSITY 1/

| SYMBOL | NAME |
|---|---|
| AGB | Agustin association, undulating |
| BA | Badlands |
| BPC | Bluepoint association, rolling (W) |
| BUC | Bluepoint gravelly association, rolling |
| DCB | Delnorte-Canutio association, undulating |
| DCD | Delnorte-Canutio association, hilly |
| DU | Dune land |
| HW | Hueco-Wink association, hummocky (W) |
| IG | Igneous rock land |
| IN | Igneous rock land-Brewster association |
| LM | Limestone rock land-Lozier association |
| LOD | Lozier association, hilly |
| MBA | Mimbres association, level |
| PAA | Pajarito association, level (W) |
| SMB | Simona association, undulating |
| TBB | Turney-Berino association, undulating |
| WKA | Wink association, level (W) |

1/ The composition of these units is more variable than that of the other units in the county but has been controlled well enough to interpret for the expected use of the soils concerned.

## CONVENTIONAL SIGNS

### WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Cotton gin

Windmill

### BOUNDARIES

- National or state
- County
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

### DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches (CANAL)

Lakes and ponds
- Perennial (water) (w)
- Intermittent (int)

Spring

Well, irrigation (I.W.)

Well, water

Alluvial fan

Drainage end

### WORKS AND STRUCTURES (CONTINUED)

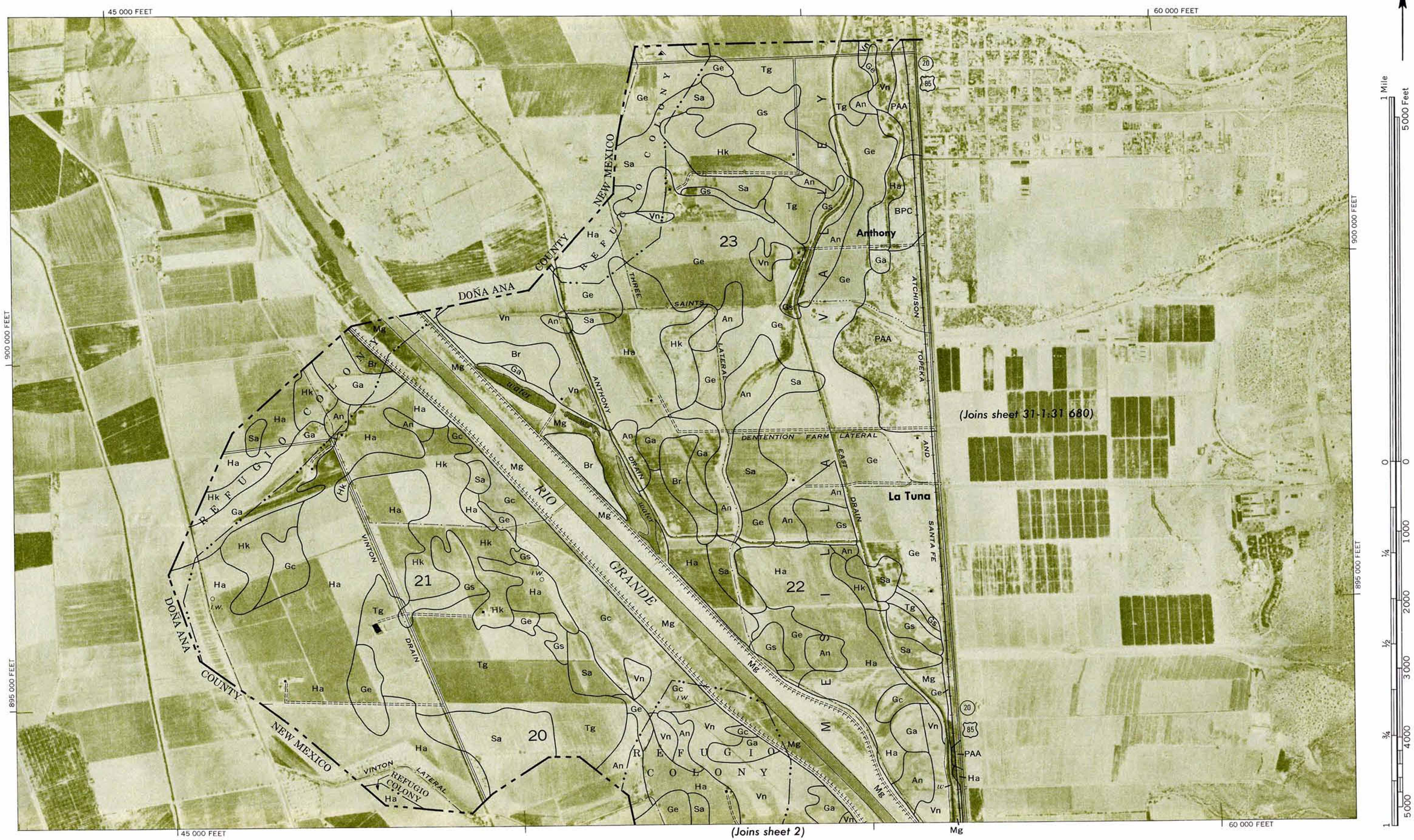
- Fence
- Fence along road, both sides
- Fence along road, one side
- Fence along county line

### SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

EL PASO COUNTY, TEXAS NO. 1




Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.


EL PASO COUNTY, TEXAS NO. 2

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EL PASO COUNTY, TEXAS NO. 3


Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

# EL PASO COUNTY, TEXAS — SHEET NUMBER 4



EL PASO COUNTY, TEXAS NO. 4

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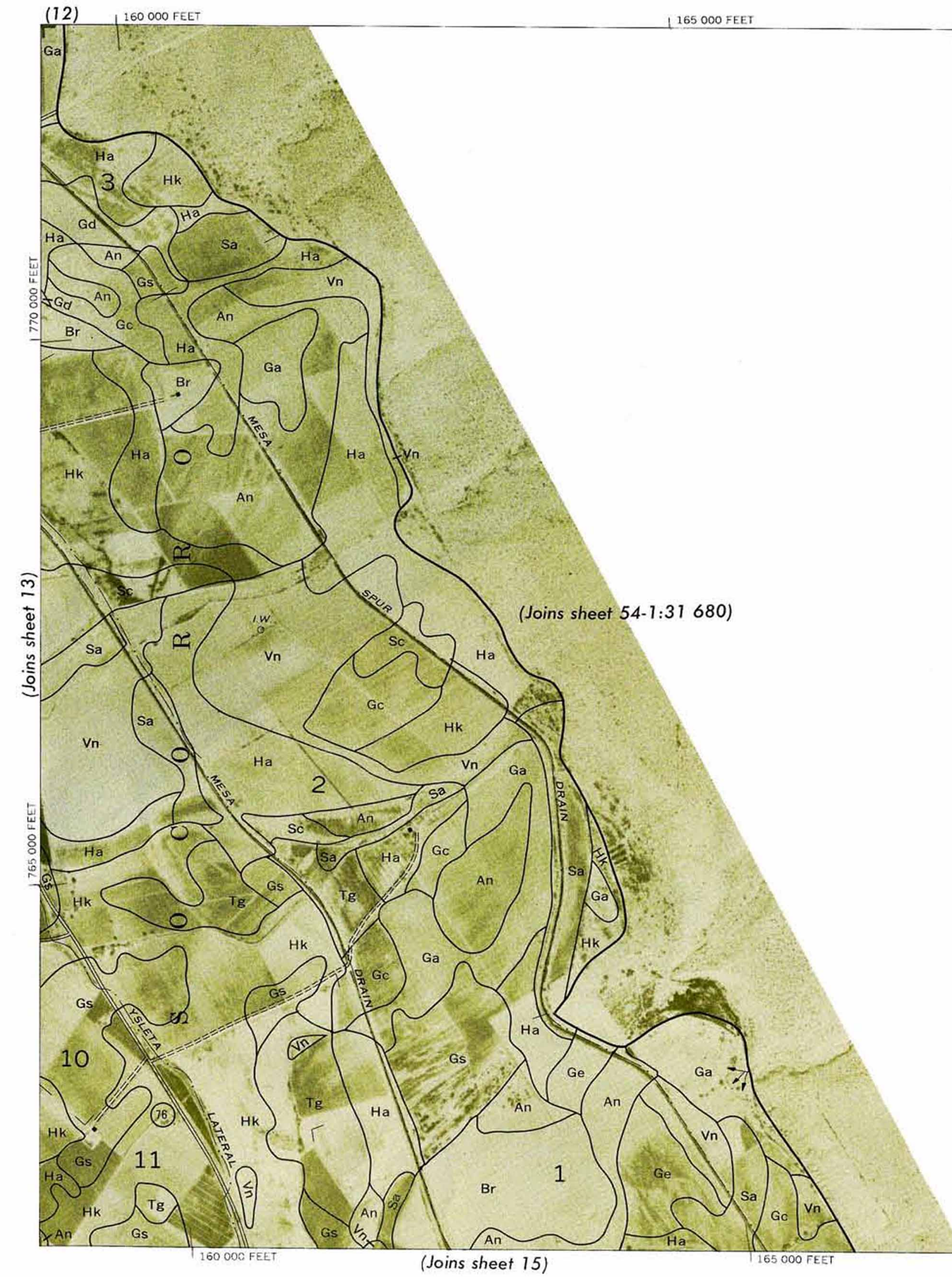
EL PASO COUNTY, TEXAS NO. 5

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.






EL PASO COUNTY, TEXAS NO. 10

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EL PASO COUNTY, TEXAS NO. 11

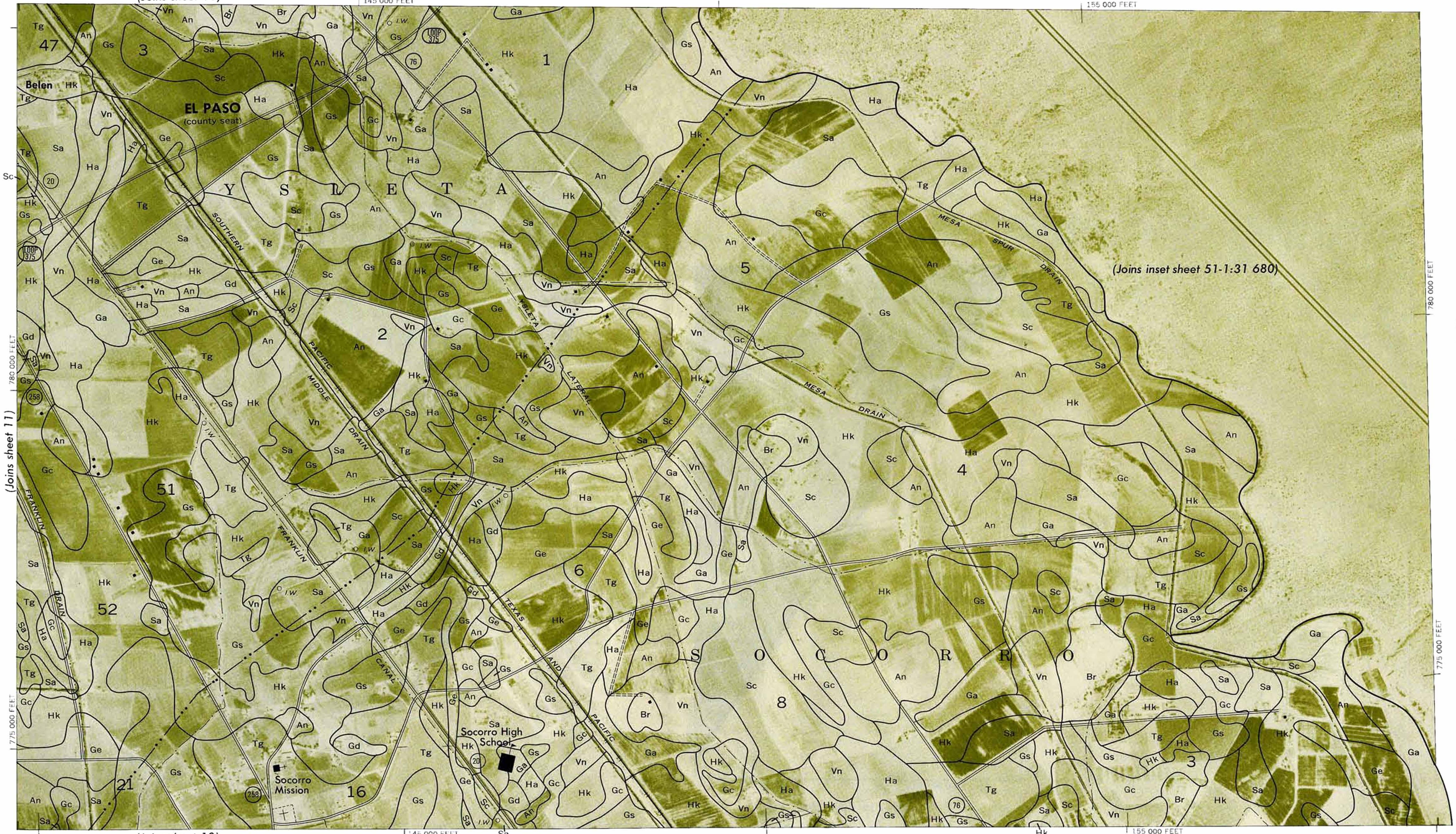
Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

EL PASO COUNTY, TEXAS — SHEET NUMBER 12

12

N

(Joins sheet 10)




(Joins sheet 11)

(Joins sheet 13)

1 Mile
5000 Feet
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

EL PASO COUNTY, TEXAS NO. 12

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EL PASO COUNTY, TEXAS NO. 13

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

EL PASO COUNTY, TEXAS — SHEET NUMBER 14


EL PASO COUNTY, TEXAS NO. 14

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Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

15

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EL PASO COUNTY, TEXAS NO. 15


Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

EL PASO COUNTY, TEXAS — SHEET NUMBER 16


EL PASO COUNTY, TEXAS NO. 16

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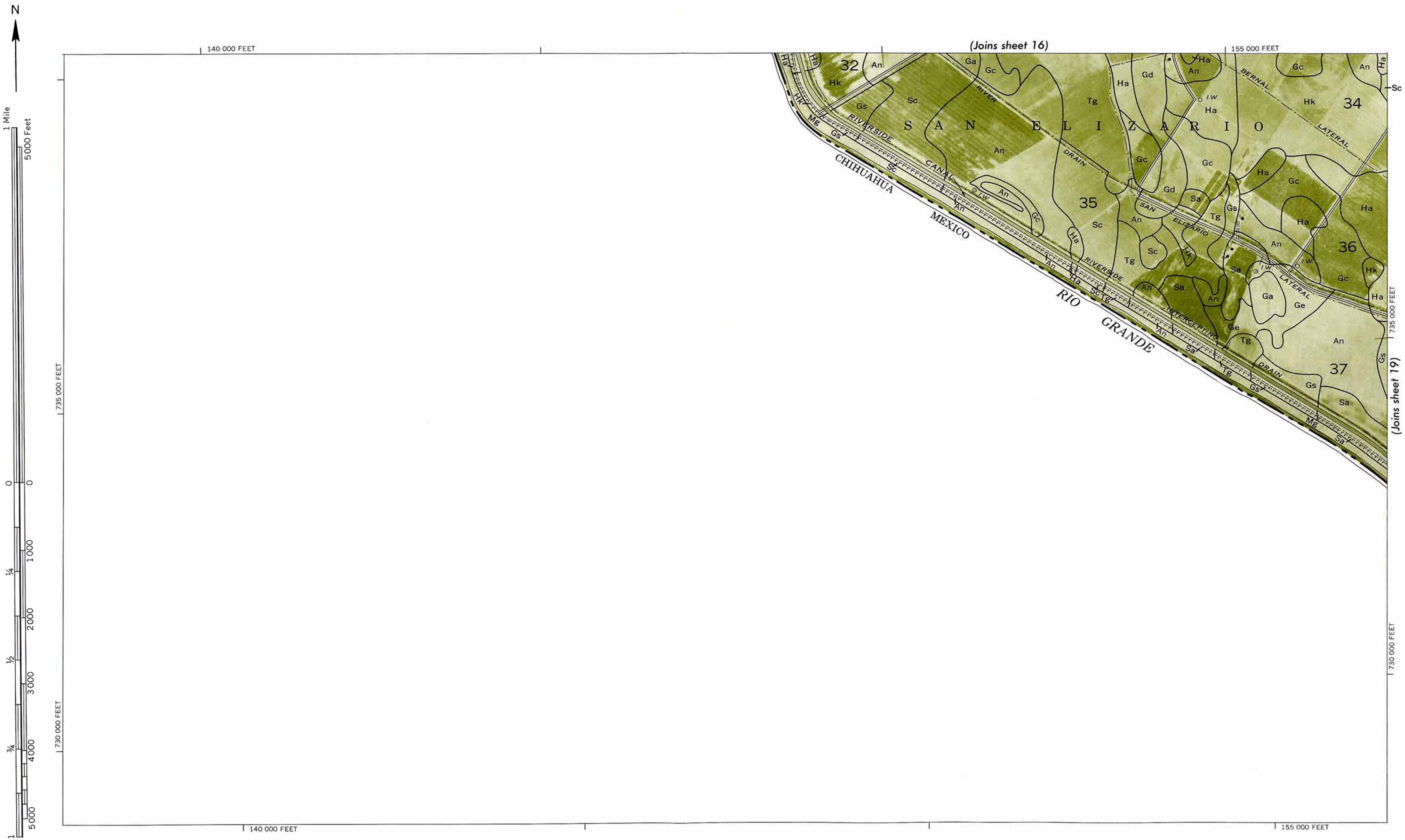
EL PASO COUNTY, TEXAS NO. 17


Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

EL PASO COUNTY, TEXAS — SHEET NUMBER 18




EL PASO COUNTY, TEXAS NO. 18

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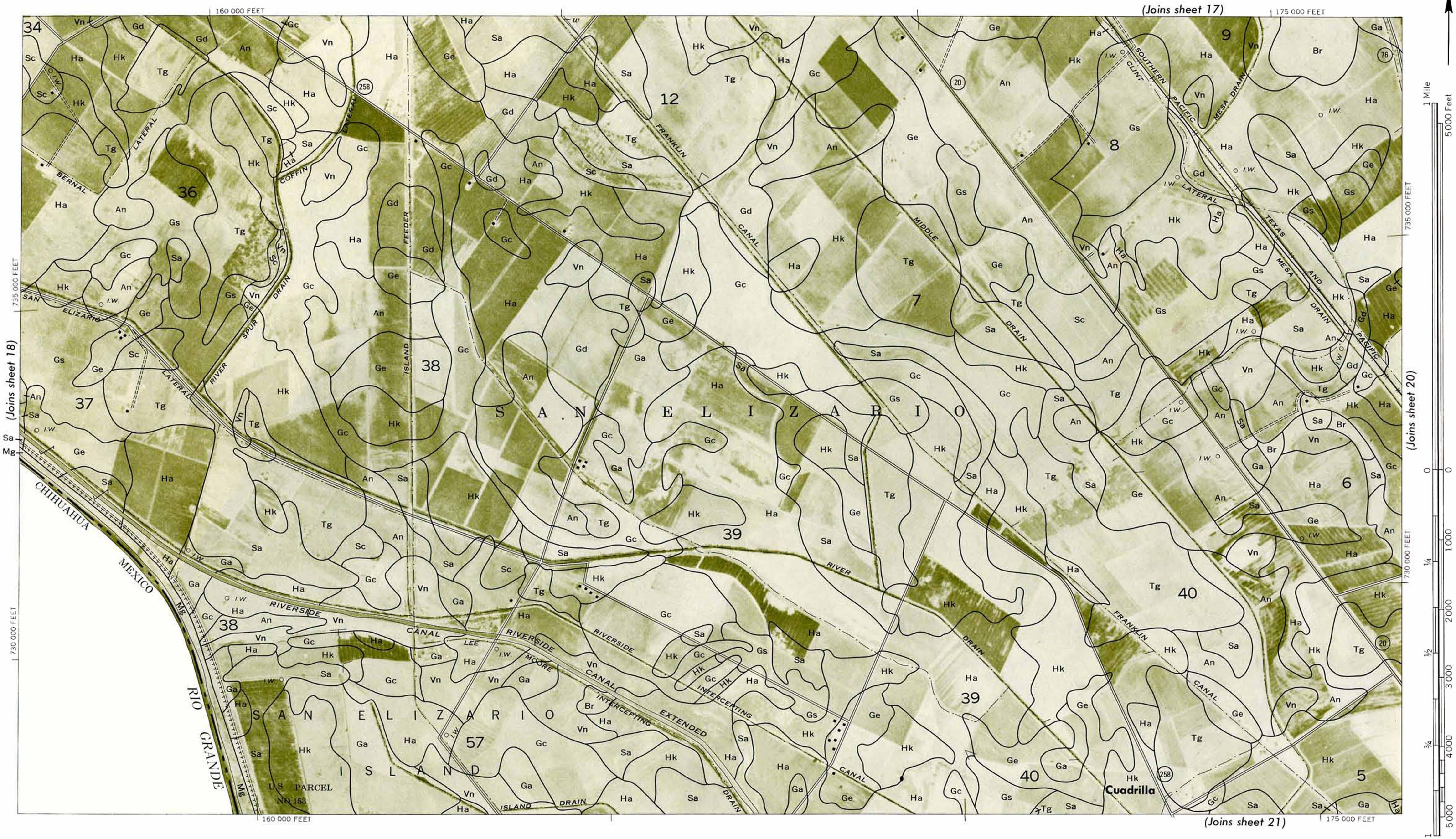


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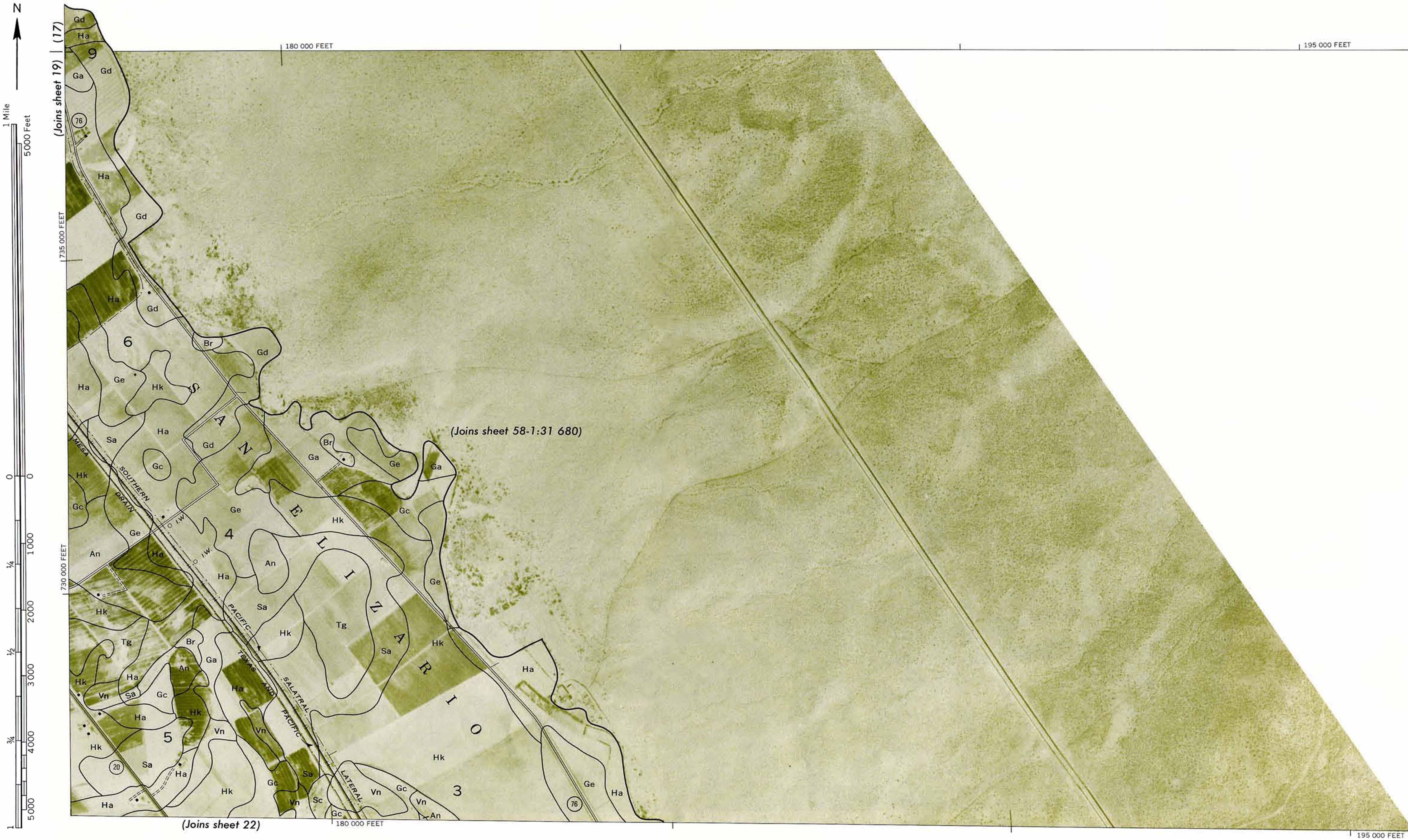
EL PASO COUNTY, TEXAS NO. 19

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

EL PASO COUNTY, TEXAS — SHEET NUMBER 20




EL PASO COUNTY, TEXAS NO. 20

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EL PASO COUNTY, TEXAS NO. 21

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EL PASO COUNTY, TEXAS NO. 22

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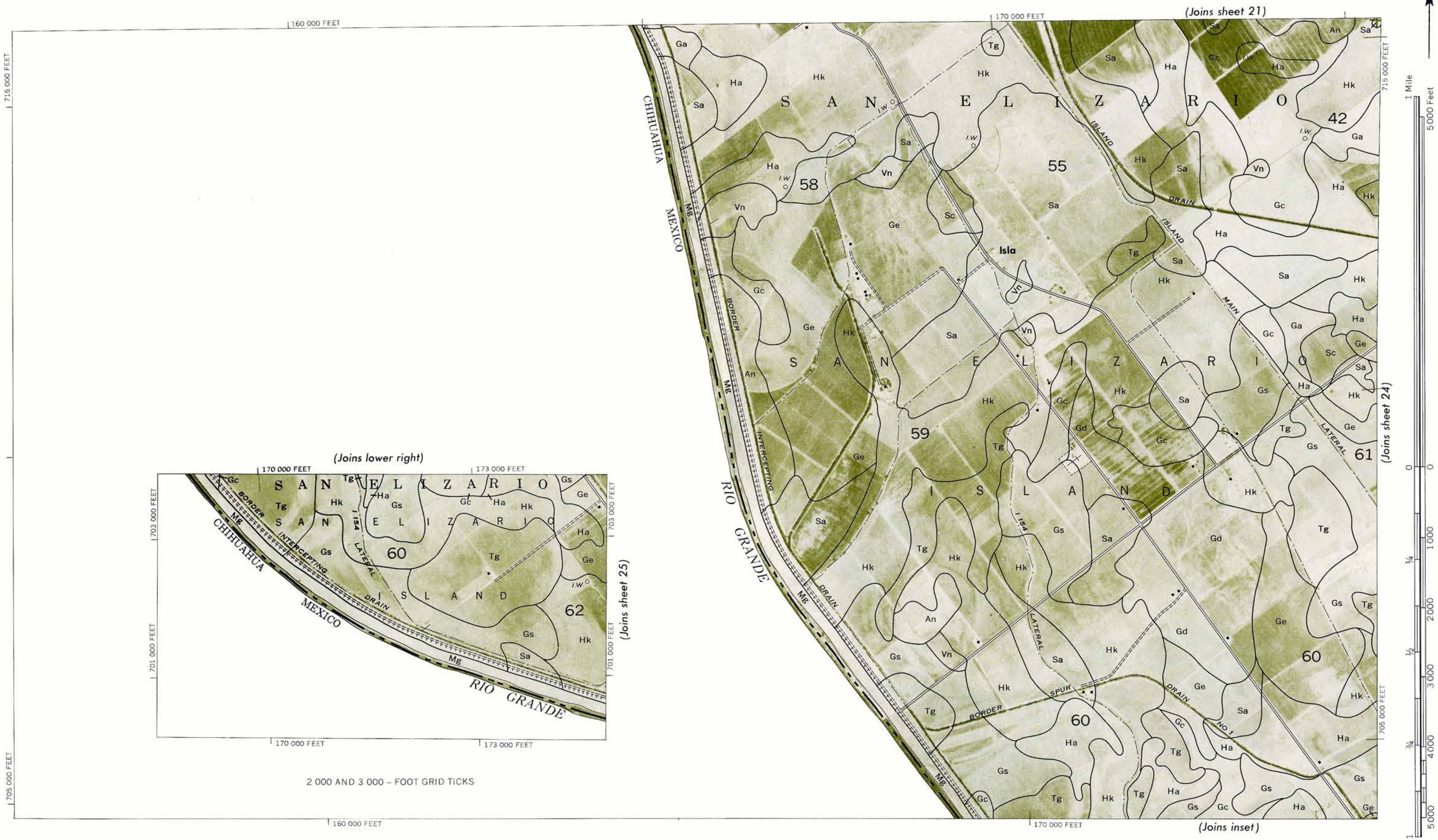


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EL PASO COUNTY, TEXAS NO. 23

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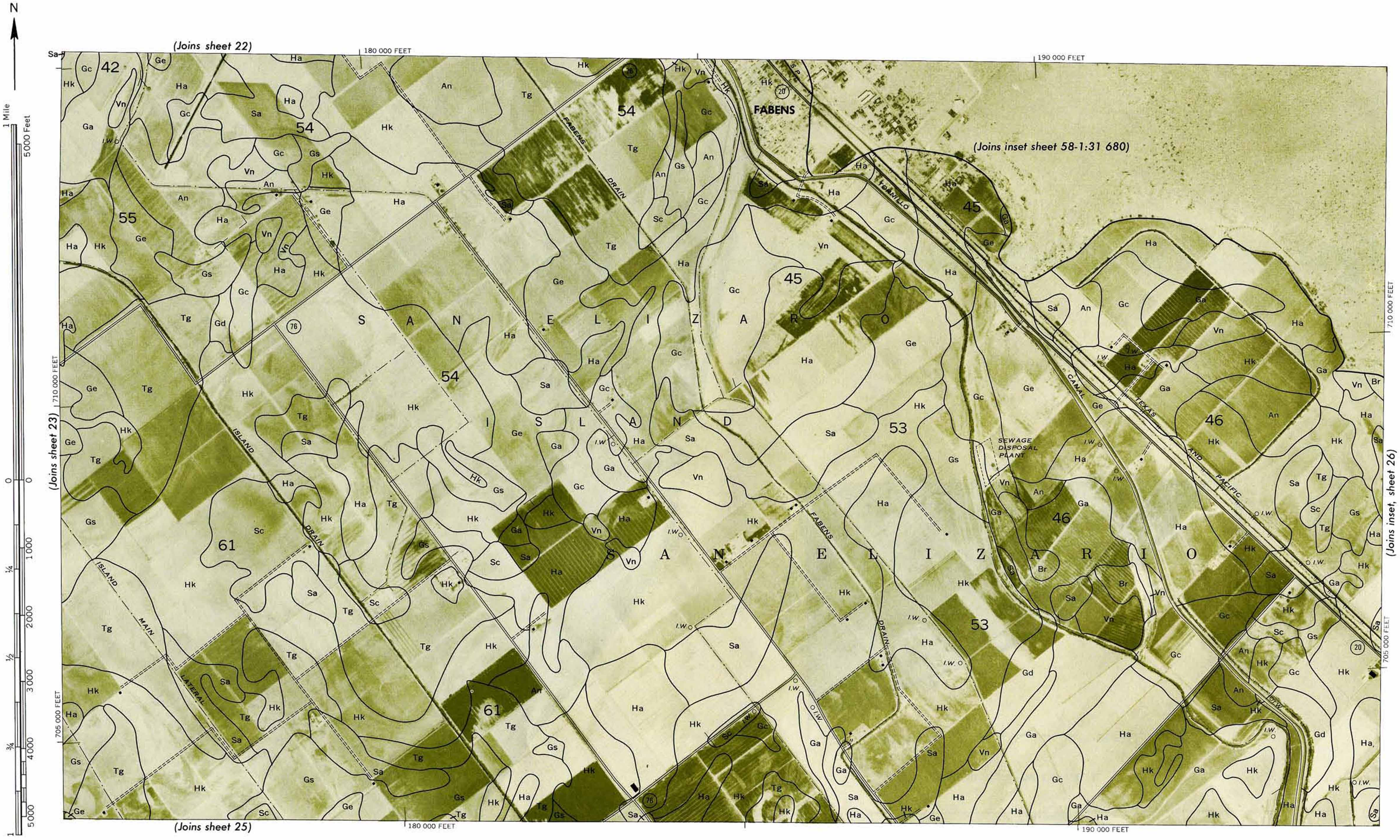
EL PASO COUNTY, TEXAS — SHEET NUMBER 24

24




EL PASO COUNTY, TEXAS NO. 24

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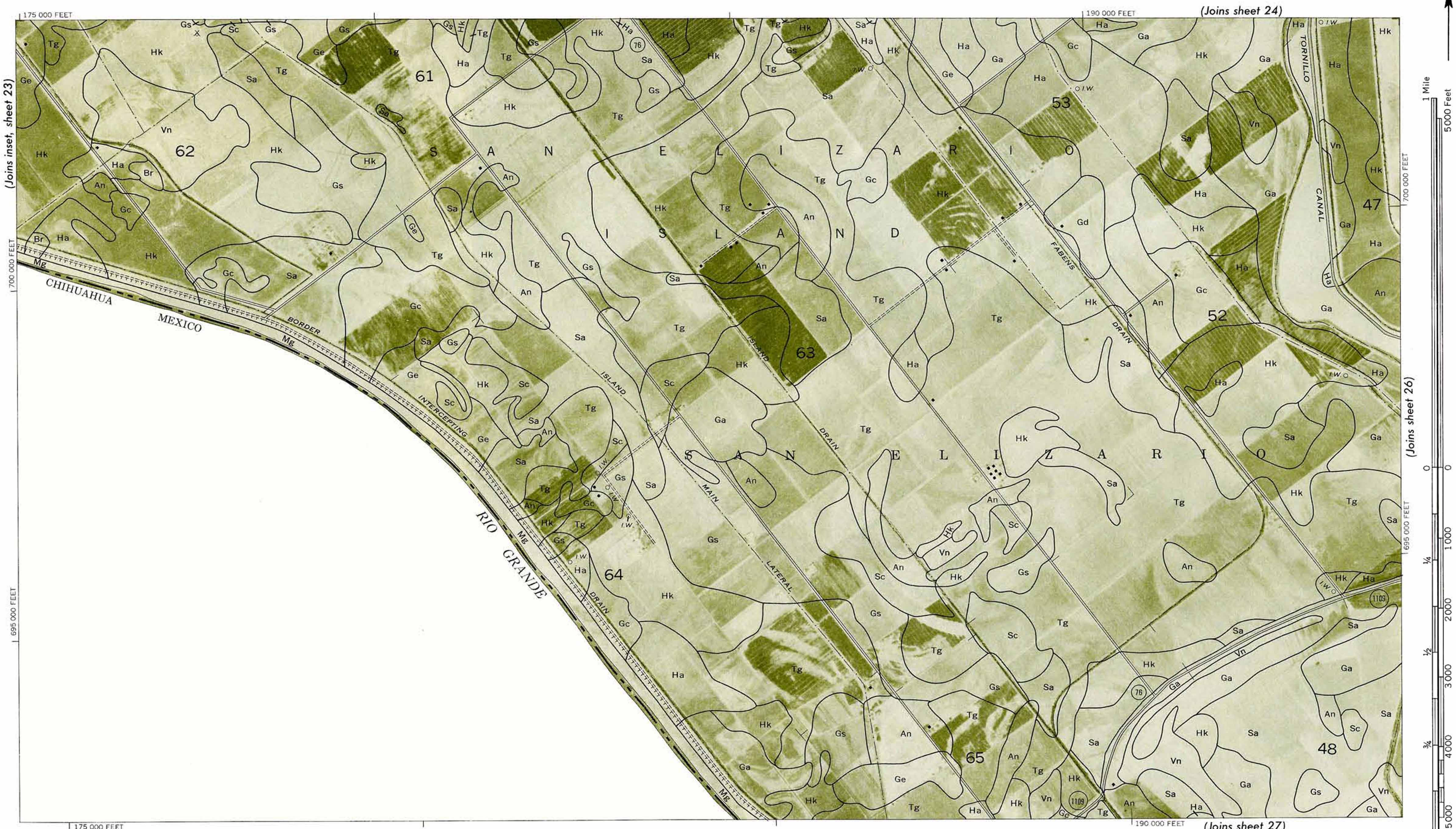


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EL PASO COUNTY, TEXAS NO. 25

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

# EL PASO COUNTY, TEXAS — SHEET NUMBER 26

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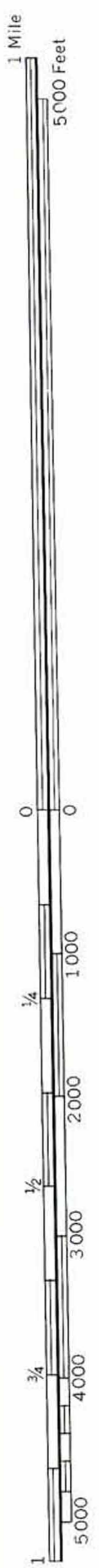



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EL PASO COUNTY, TEXAS NO. 26

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EL PASO COUNTY, TEXAS NO. 27

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EL PASO COUNTY, TEXAS NO. 29


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EL PASO COUNTY, TEXAS NO. 30

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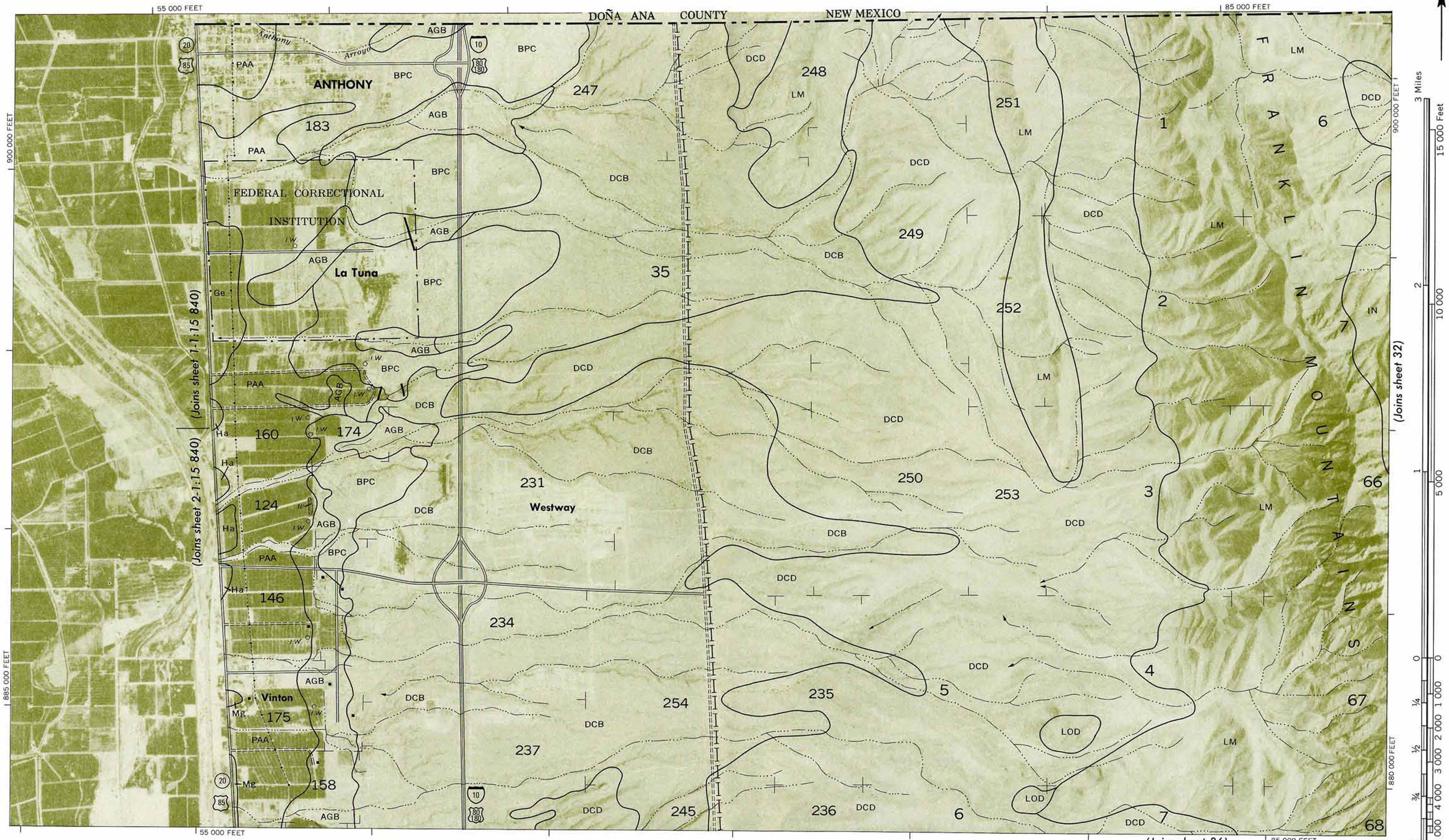


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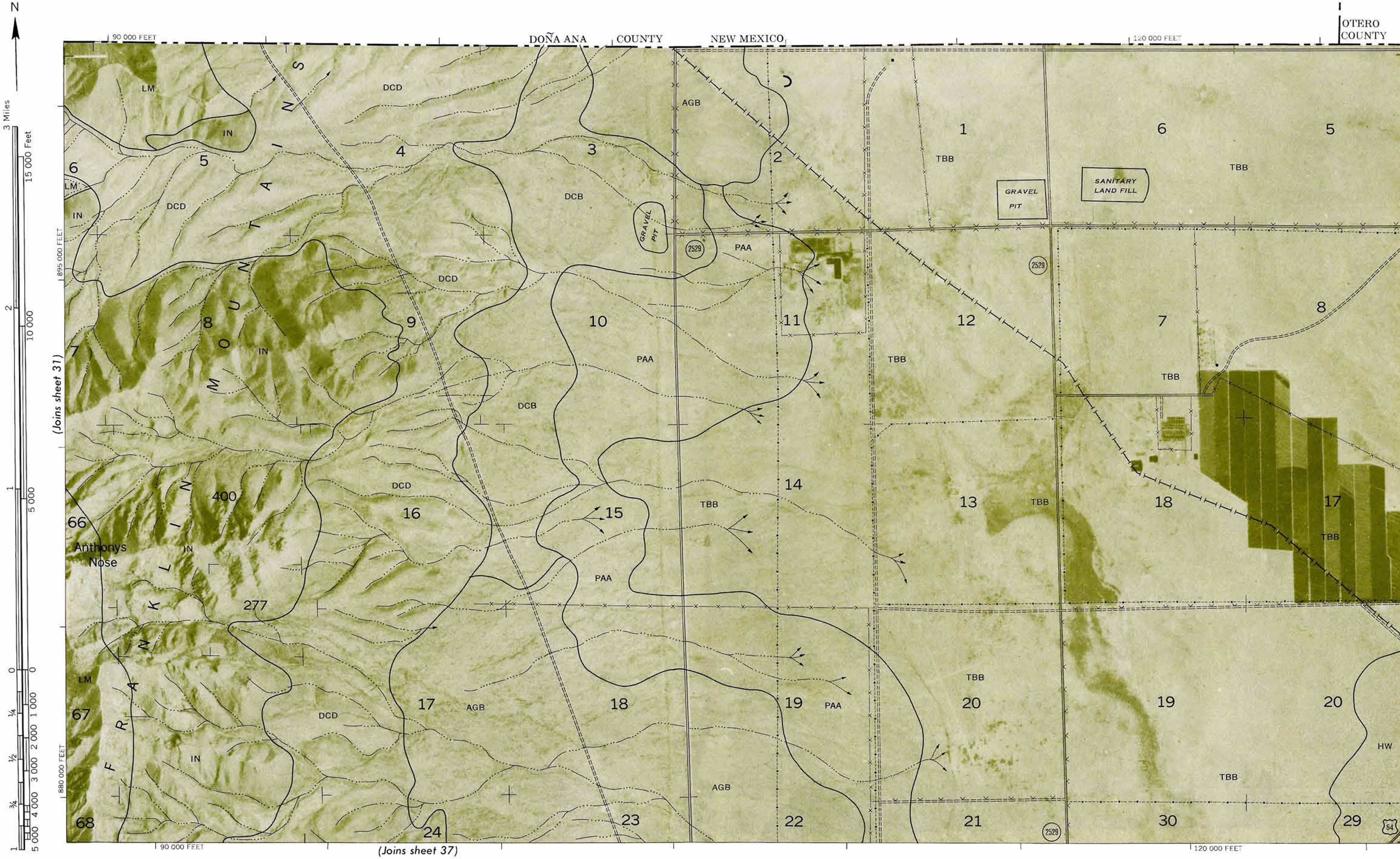
32

EL PASO COUNTY, TEXAS — SHEET NUMBER 32




EL PASO COUNTY, TEXAS NO. 32

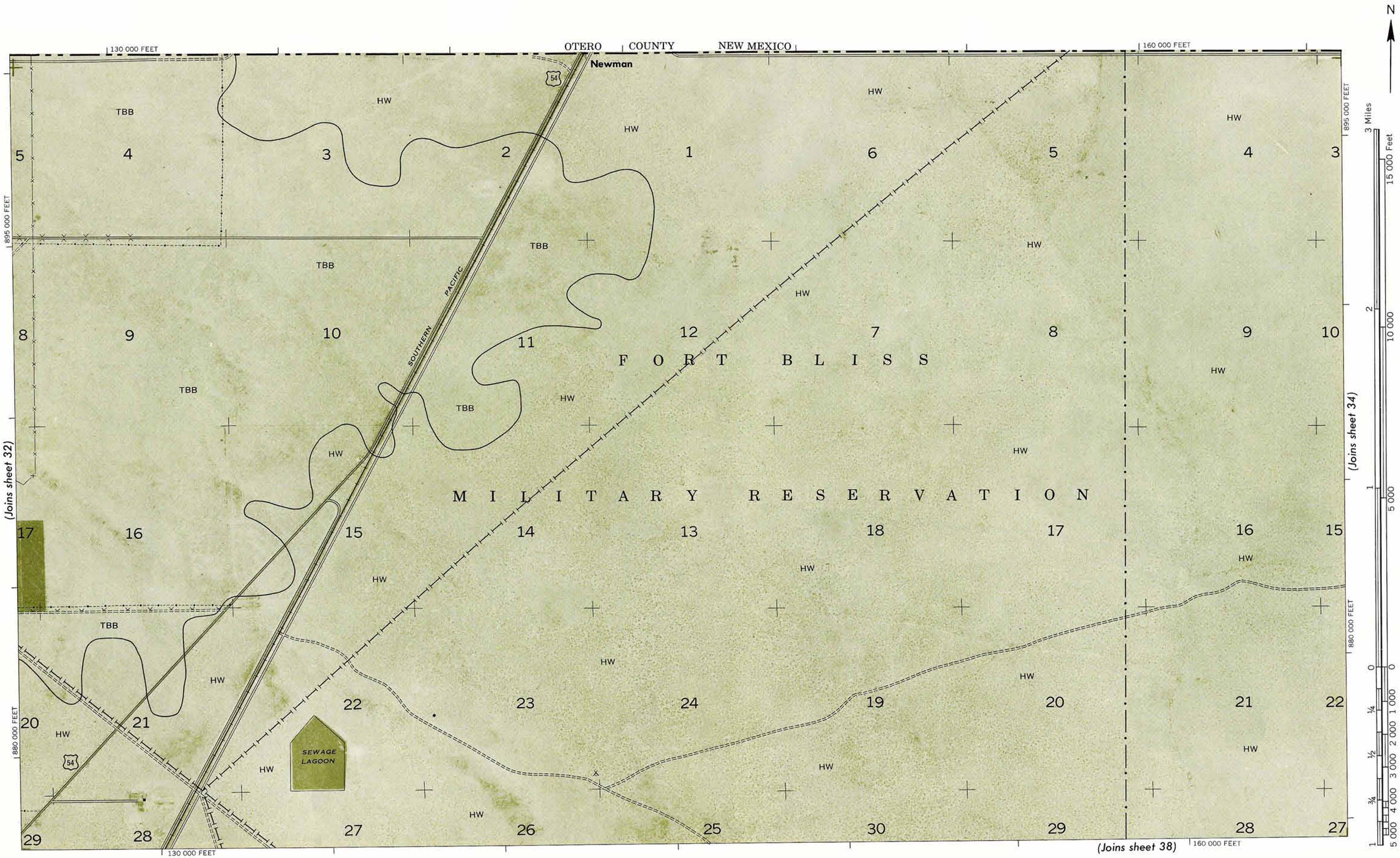
Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

EL PASO COUNTY, TEXAS NO. 33




Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

(34)

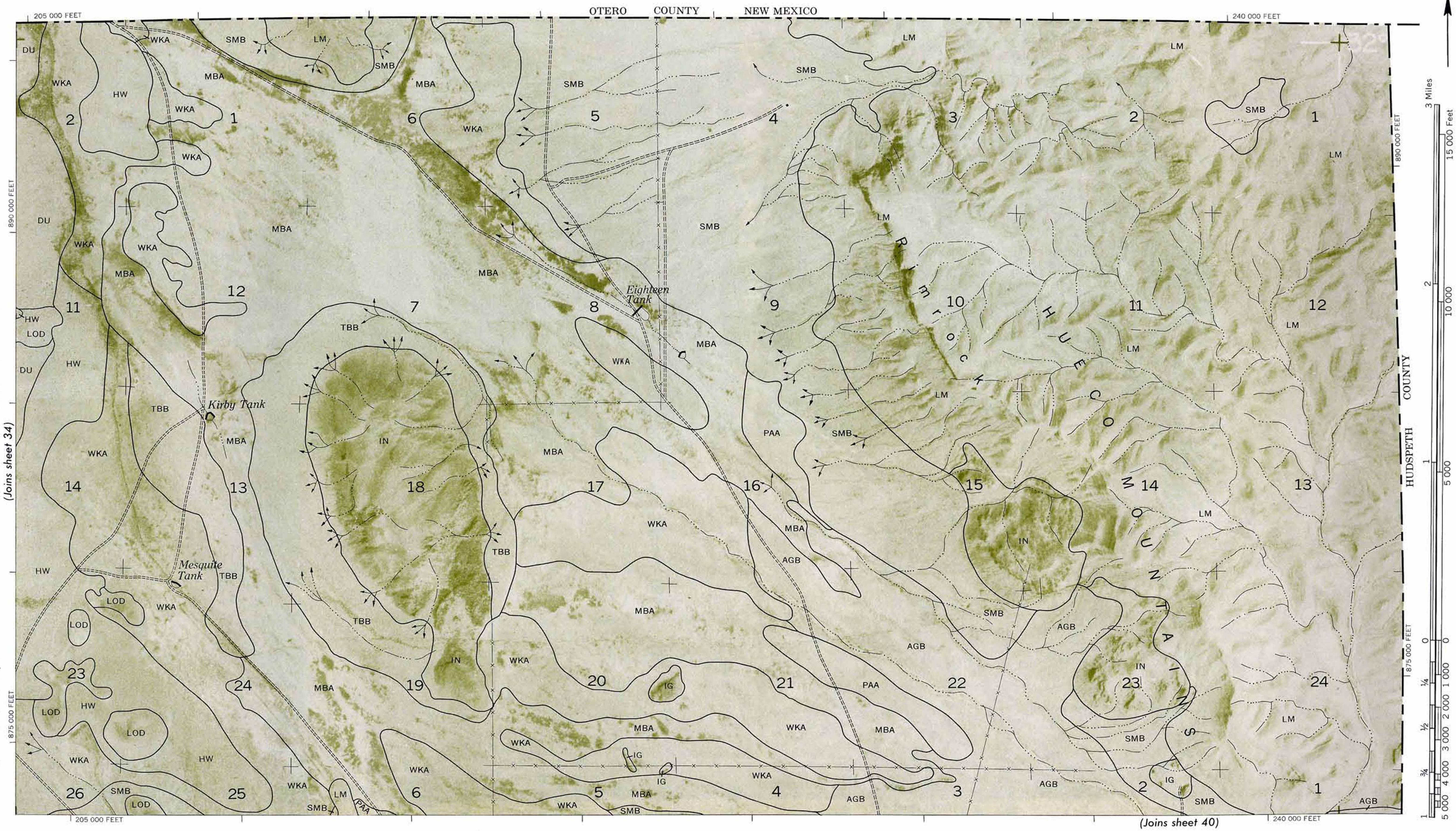
EL PASO COUNTY, TEXAS — SHEET NUMBER 34


EL PASO COUNTY, TEXAS NO. 34

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.




This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Land division corners are approximately positioned on this map.

EL PASO COUNTY, TEXAS NO. 35

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

# EL PASO COUNTY, TEXAS — SHEET NUMBER 36


EL PASO COUNTY, TEXAS NO. 36

Land division corners are approximately positioned on this map.

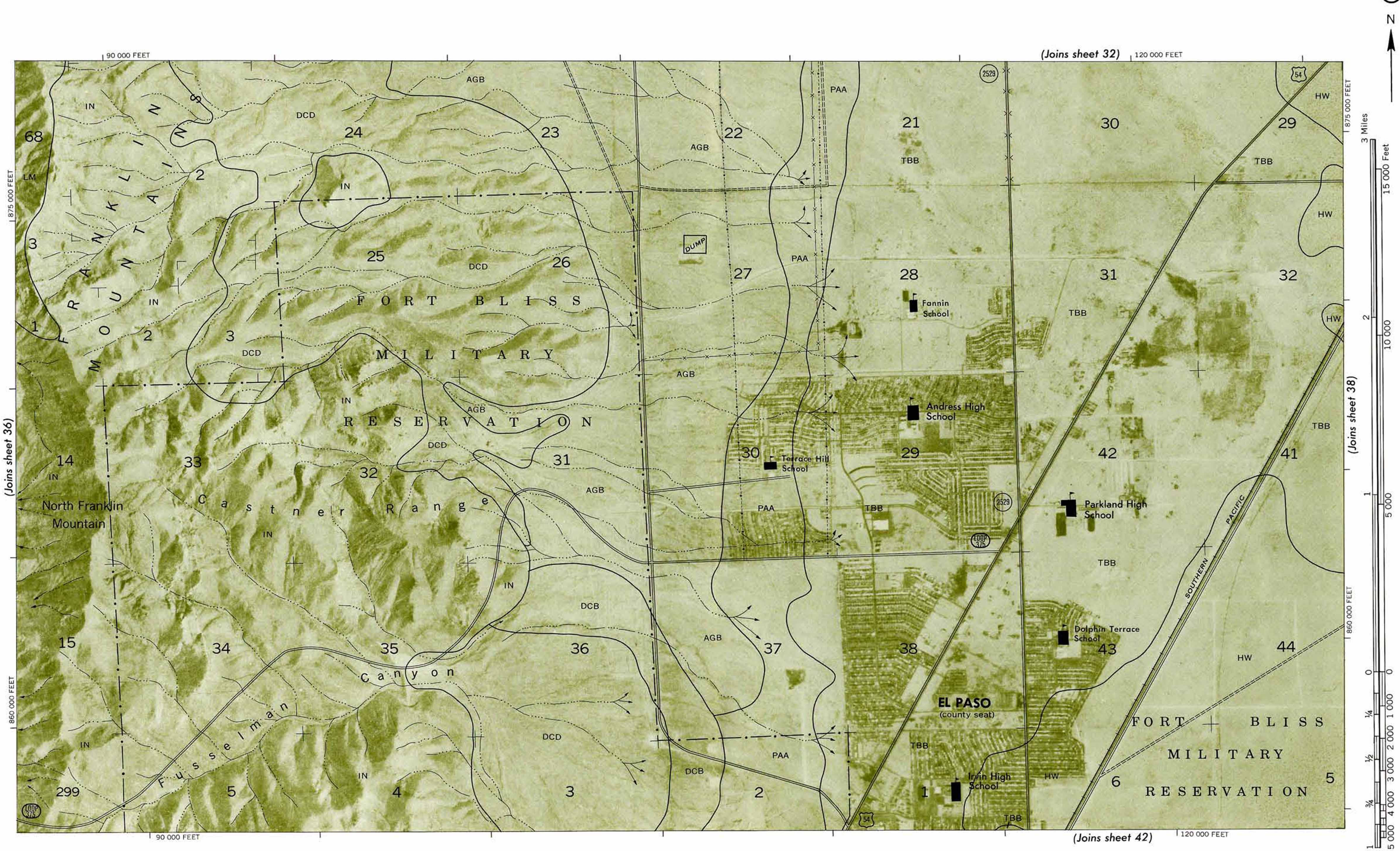
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Land division corners are approximately positioned on this map.

EL PASO COUNTY, TEXAS NO. 37

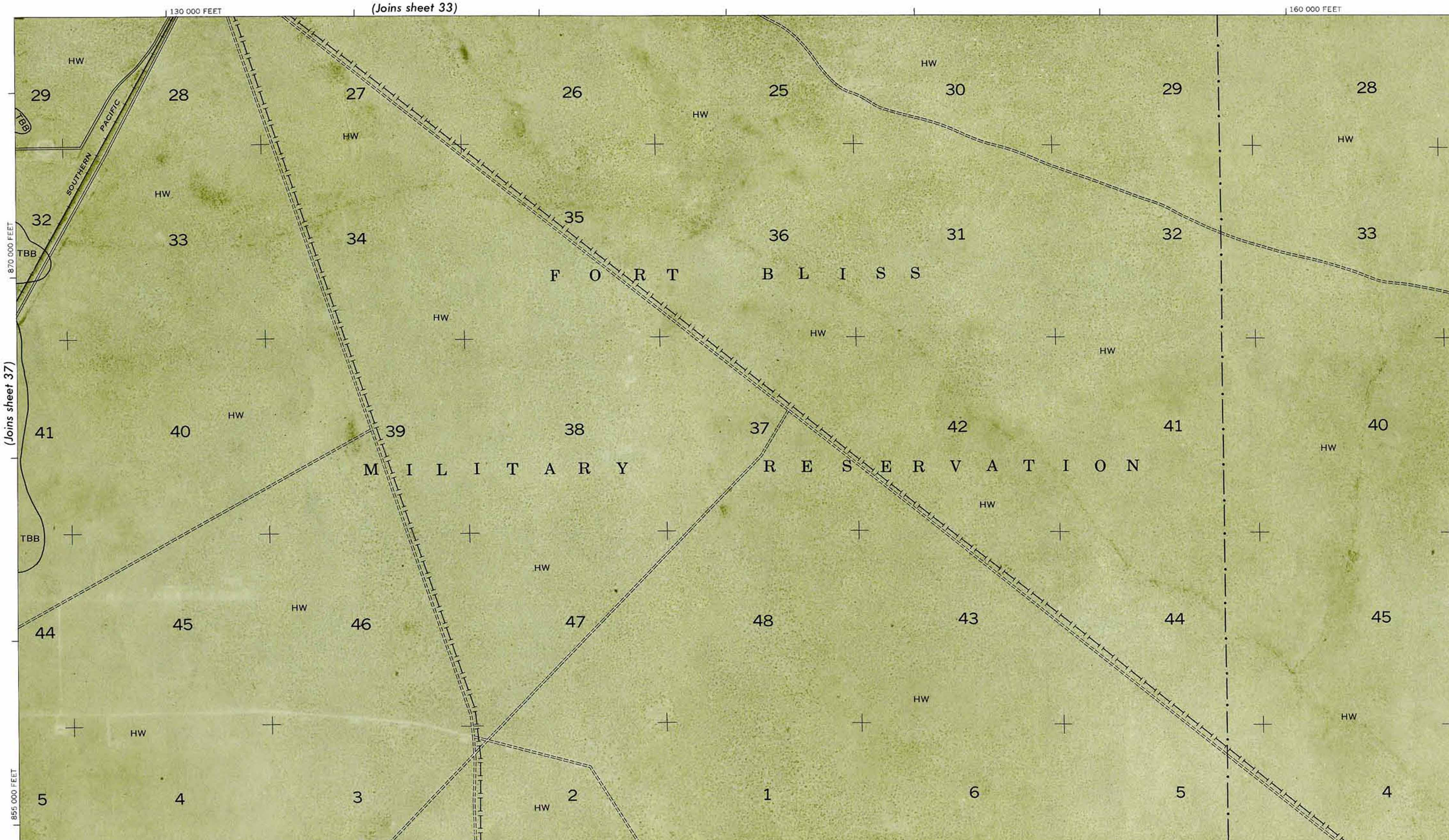



Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

(38)

EL PASO COUNTY, TEXAS — SHEET NUMBER 38


(Joins sheet 33)




(Joins sheet 37)

(Joins sheet 39)

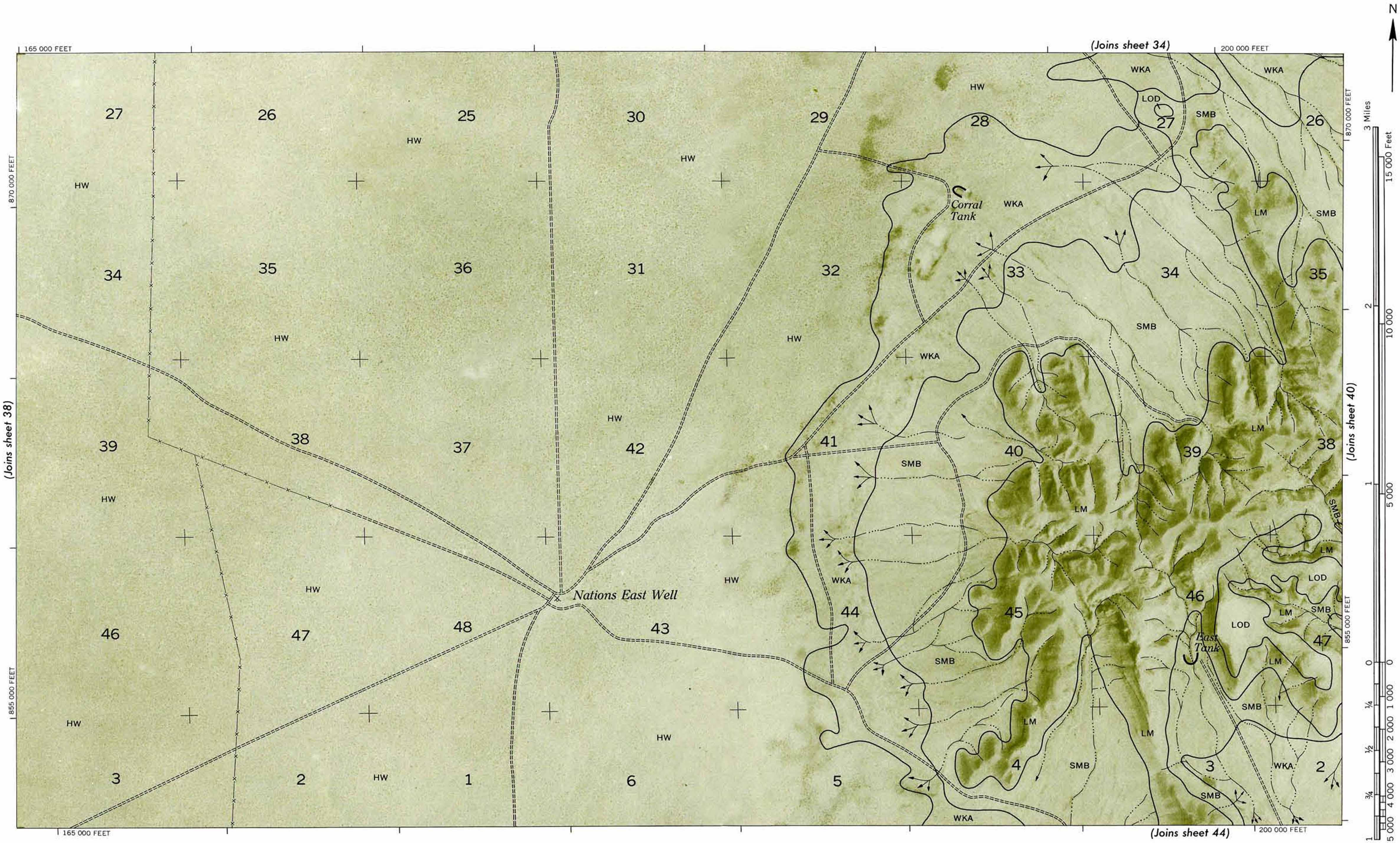
(Joins sheet 43)

EL PASO COUNTY, TEXAS NO. 38

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

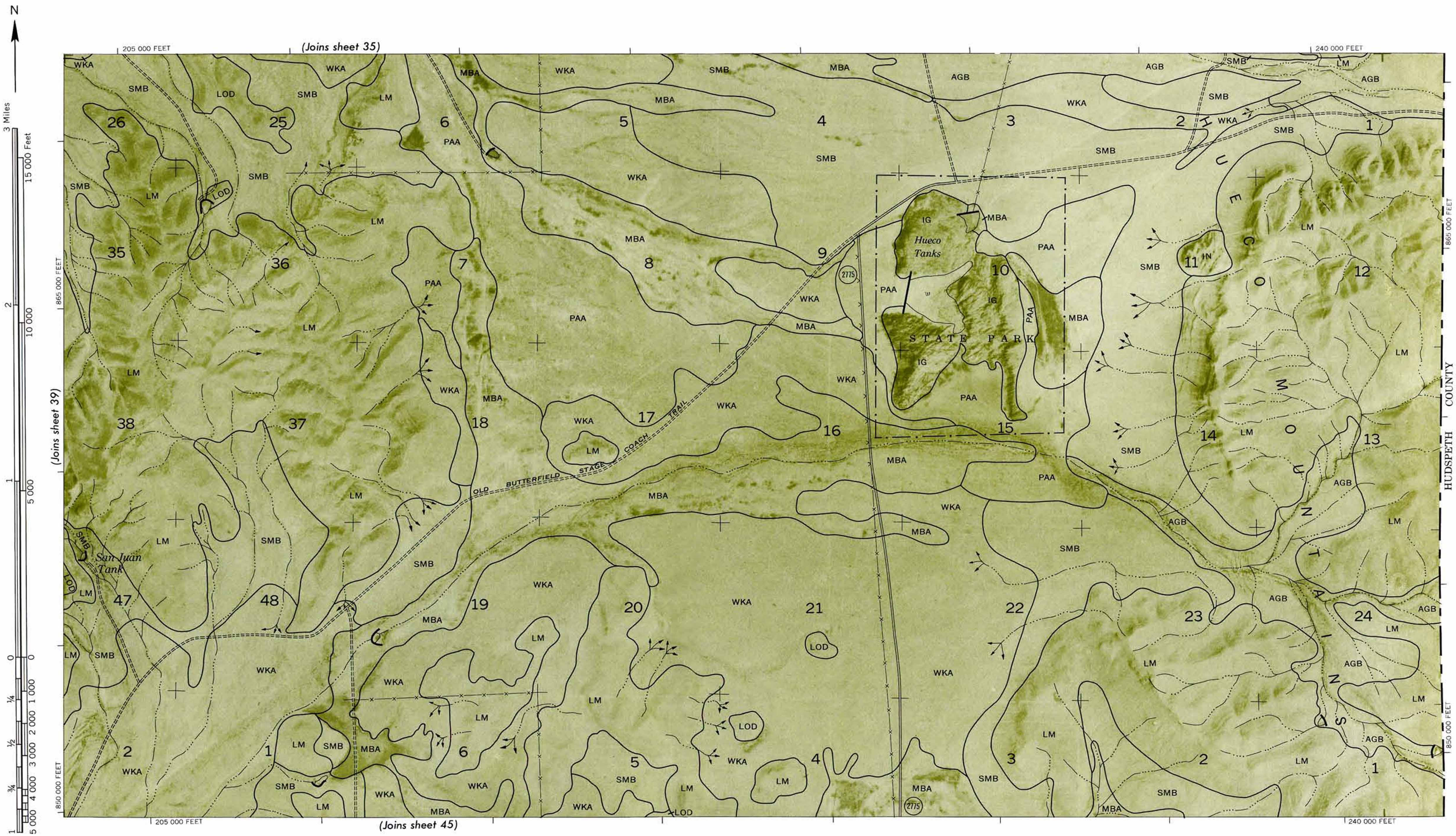



This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

EL PASO COUNTY, TEXAS NO. 39

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

EL PASO COUNTY, TEXAS — SHEET NUMBER 40

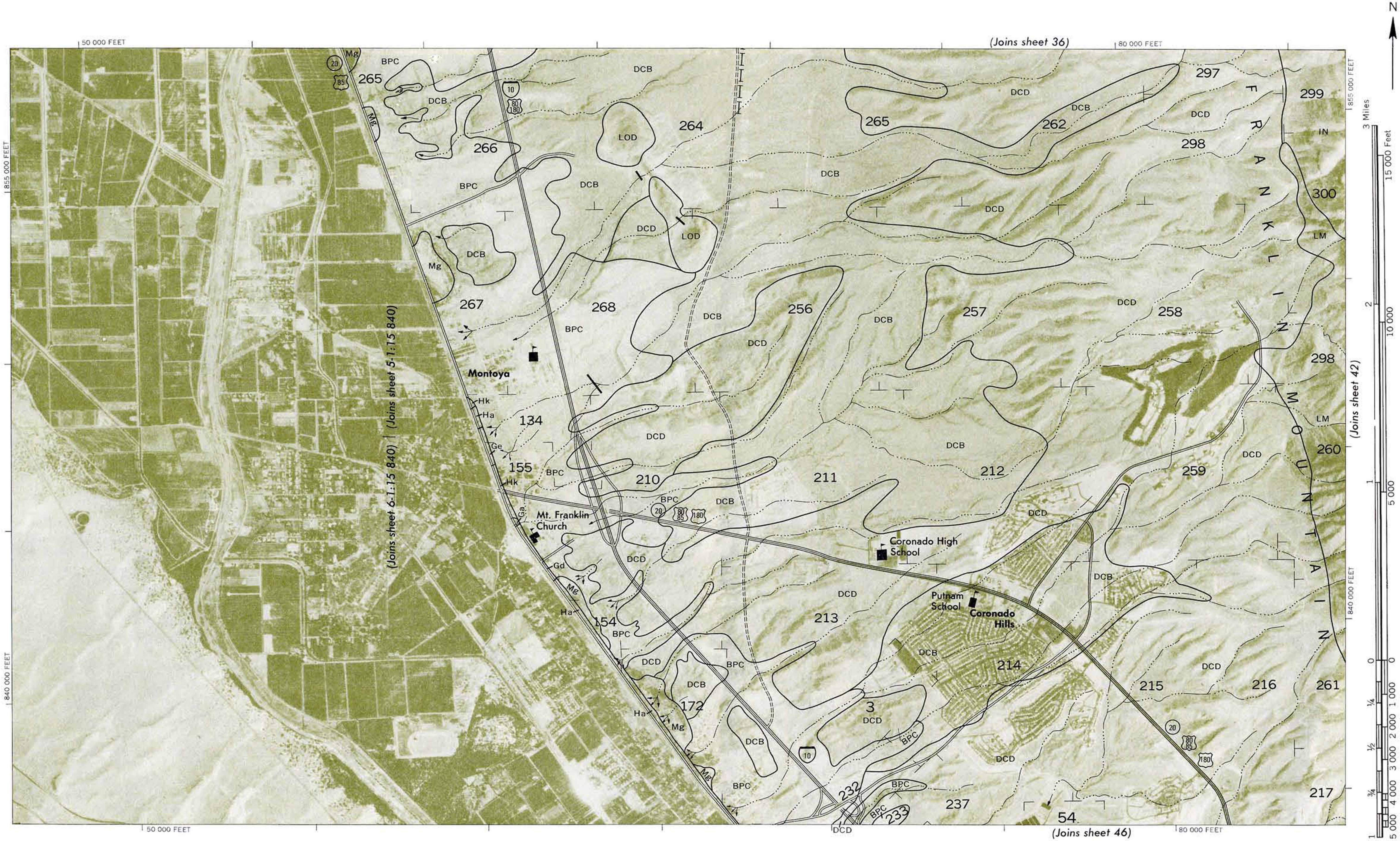





Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

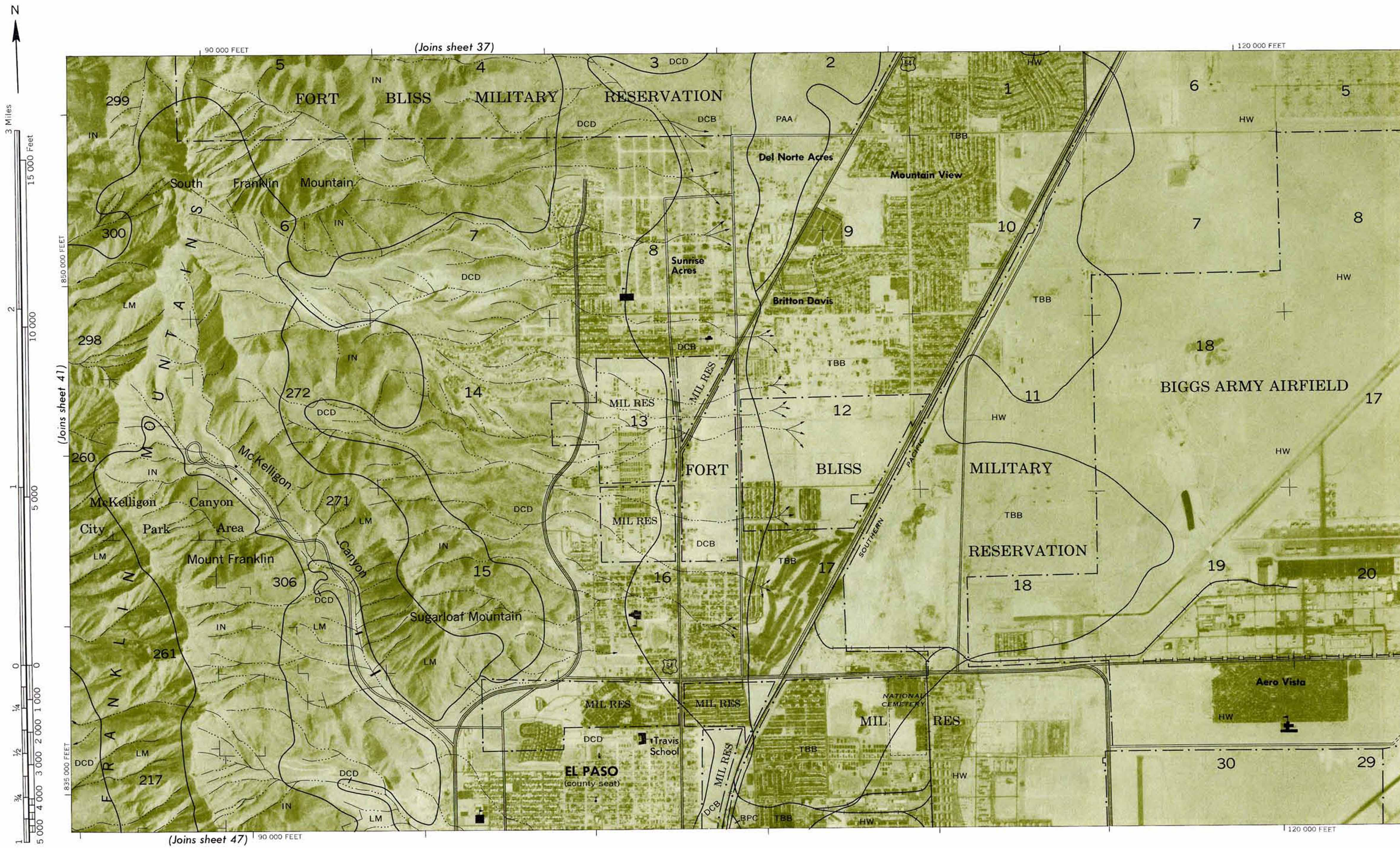
EL PASO COUNTY, TEXAS NO. 41




Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

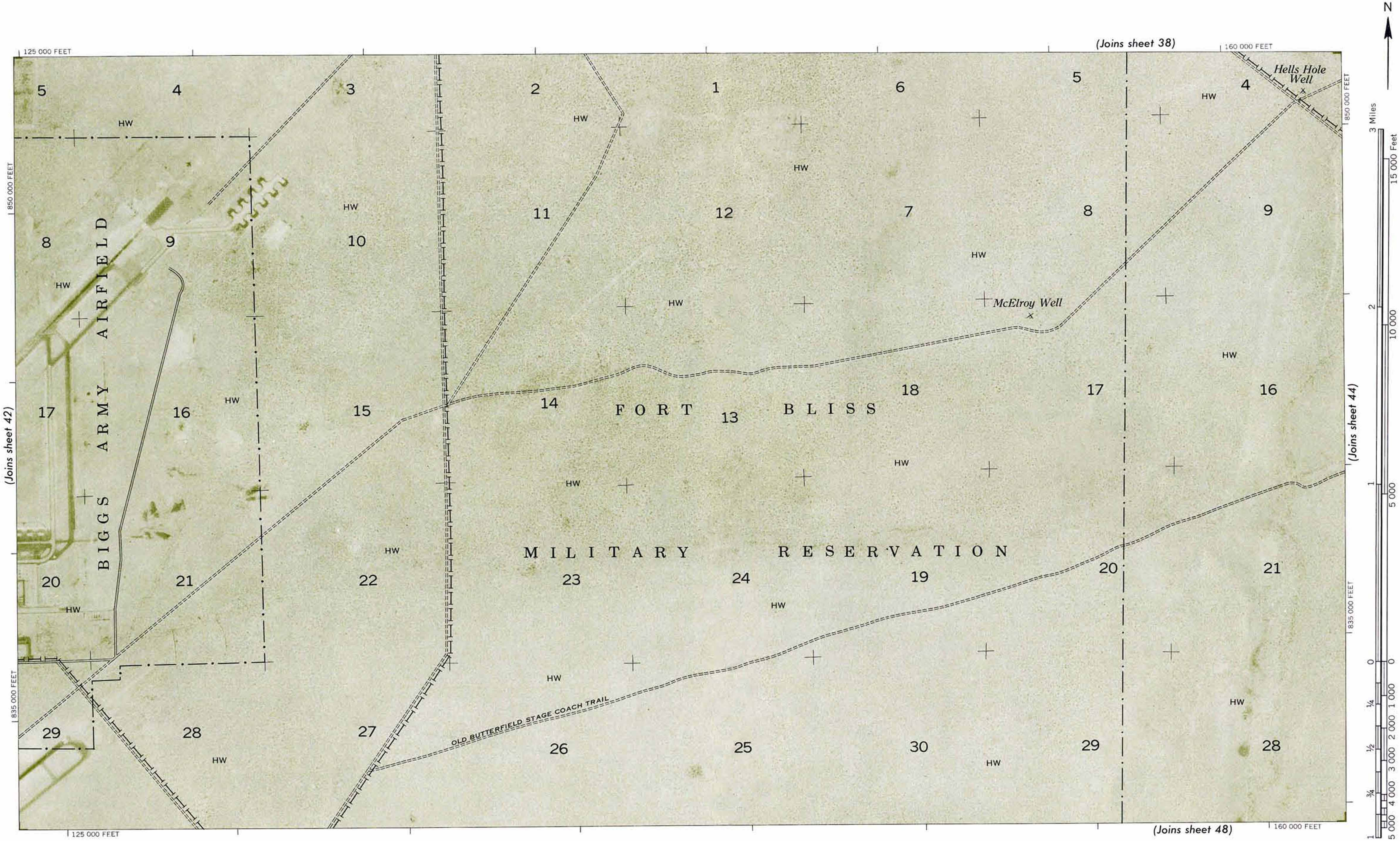
(42)

EL PASO COUNTY, TEXAS — SHEET NUMBER 42




EL PASO COUNTY, TEXAS NO. 42
Land division corners are approximately positioned on this map.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.



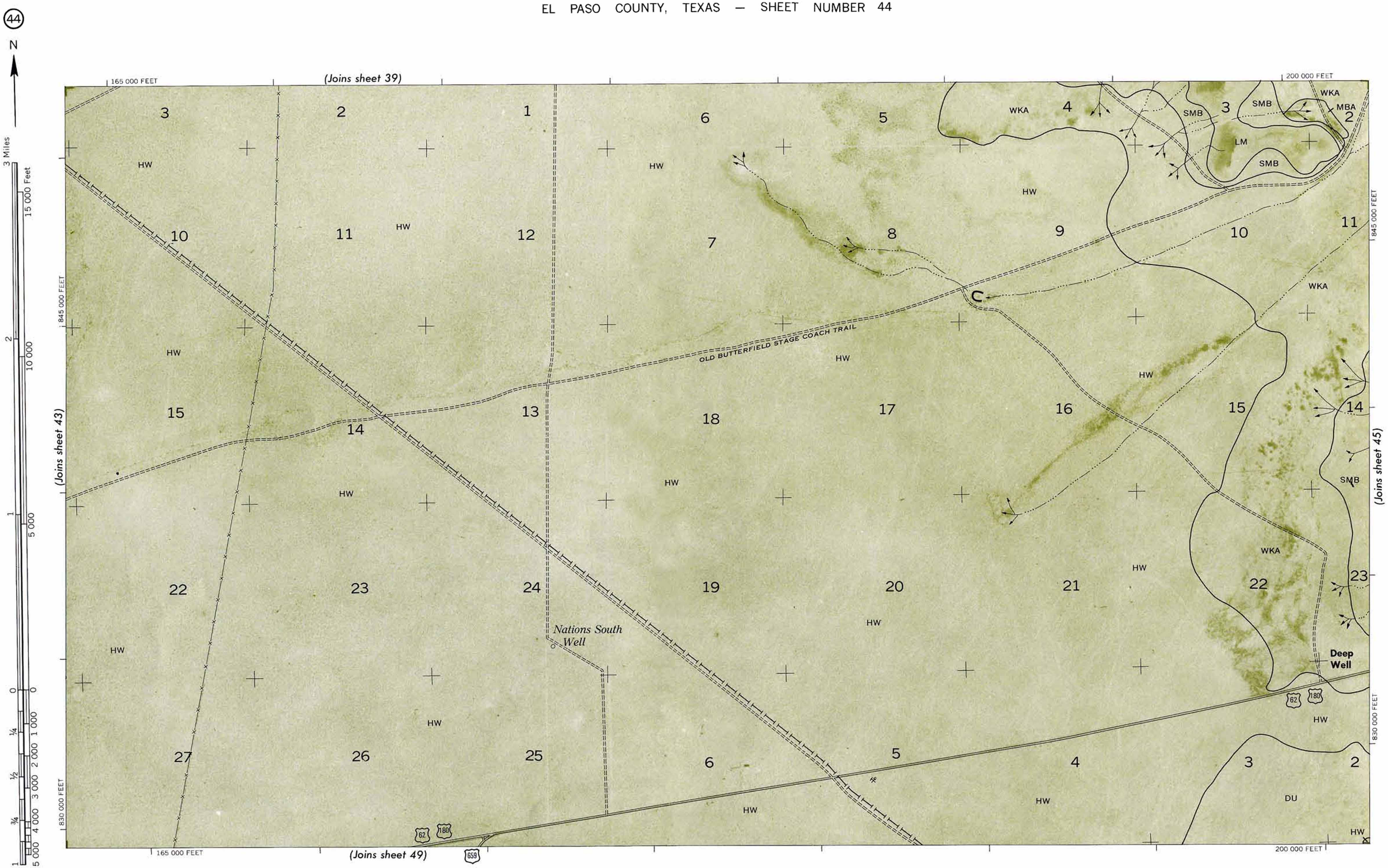

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Land division corners are approximately positioned on this map.

EL PASO COUNTY, TEXAS NO. 43

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

EL PASO COUNTY, TEXAS — SHEET NUMBER 44

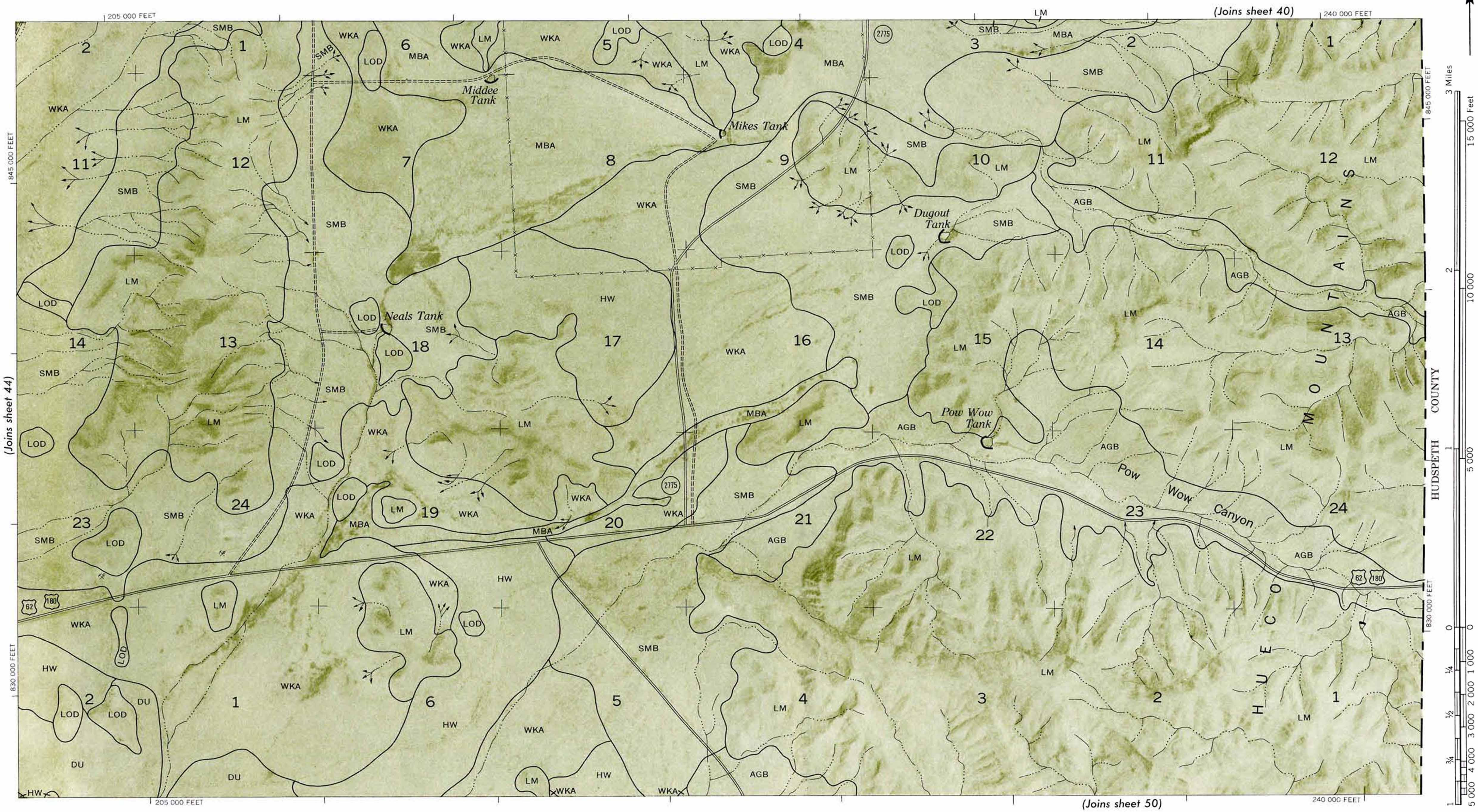



EL PASO COUNTY, TEXAS NO. 44

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

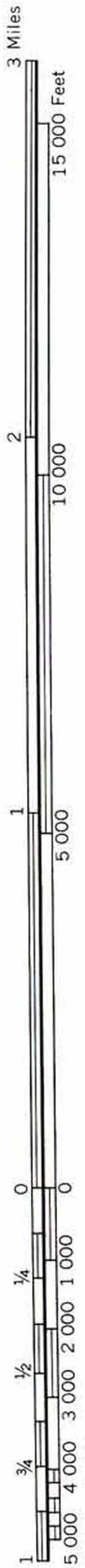


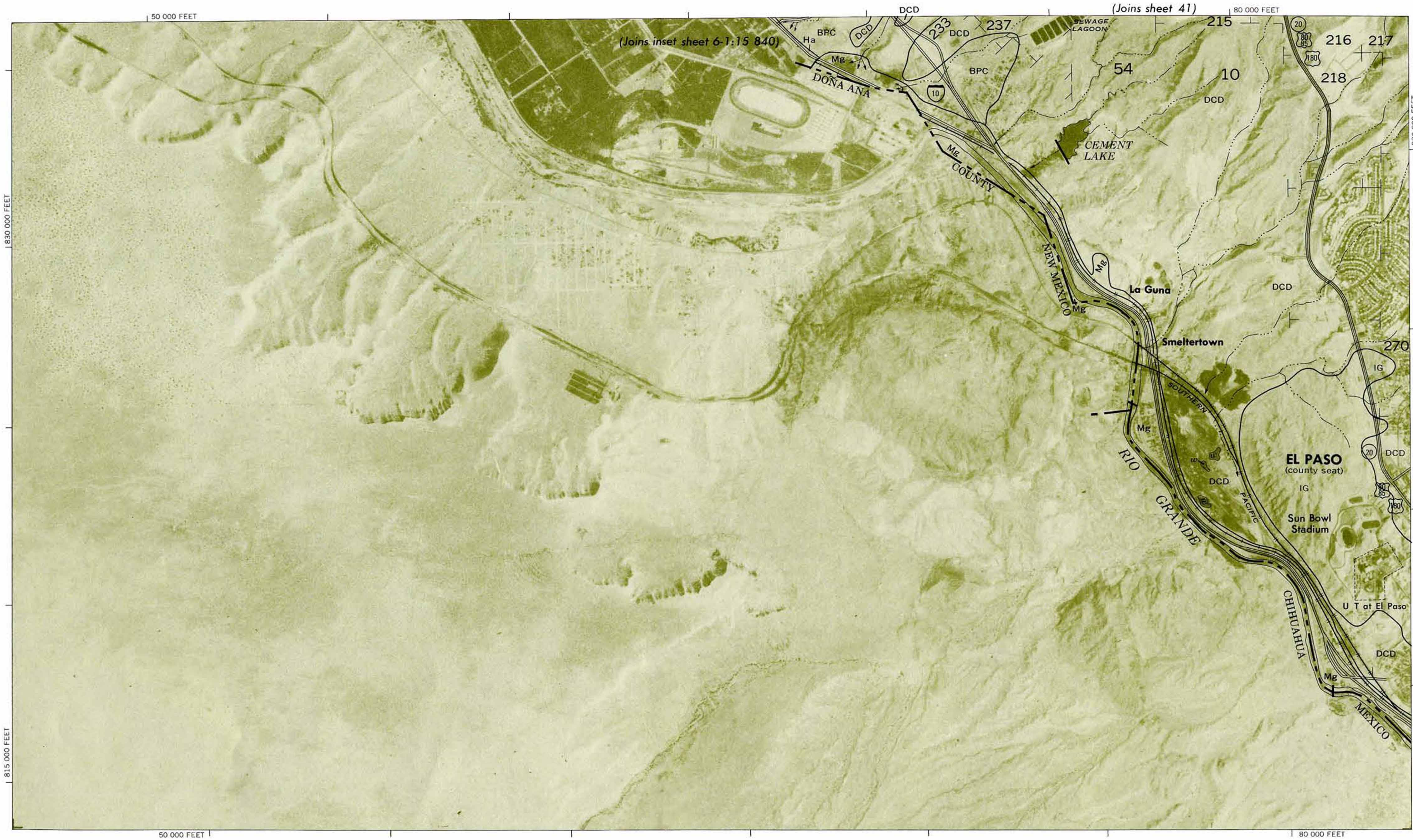

EL PASO COUNTY, TEXAS NO. 45

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

N

EL PASO COUNTY, TEXAS — SHEET NUMBER 46




EL PASO COUNTY, TEXAS NO. 46

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

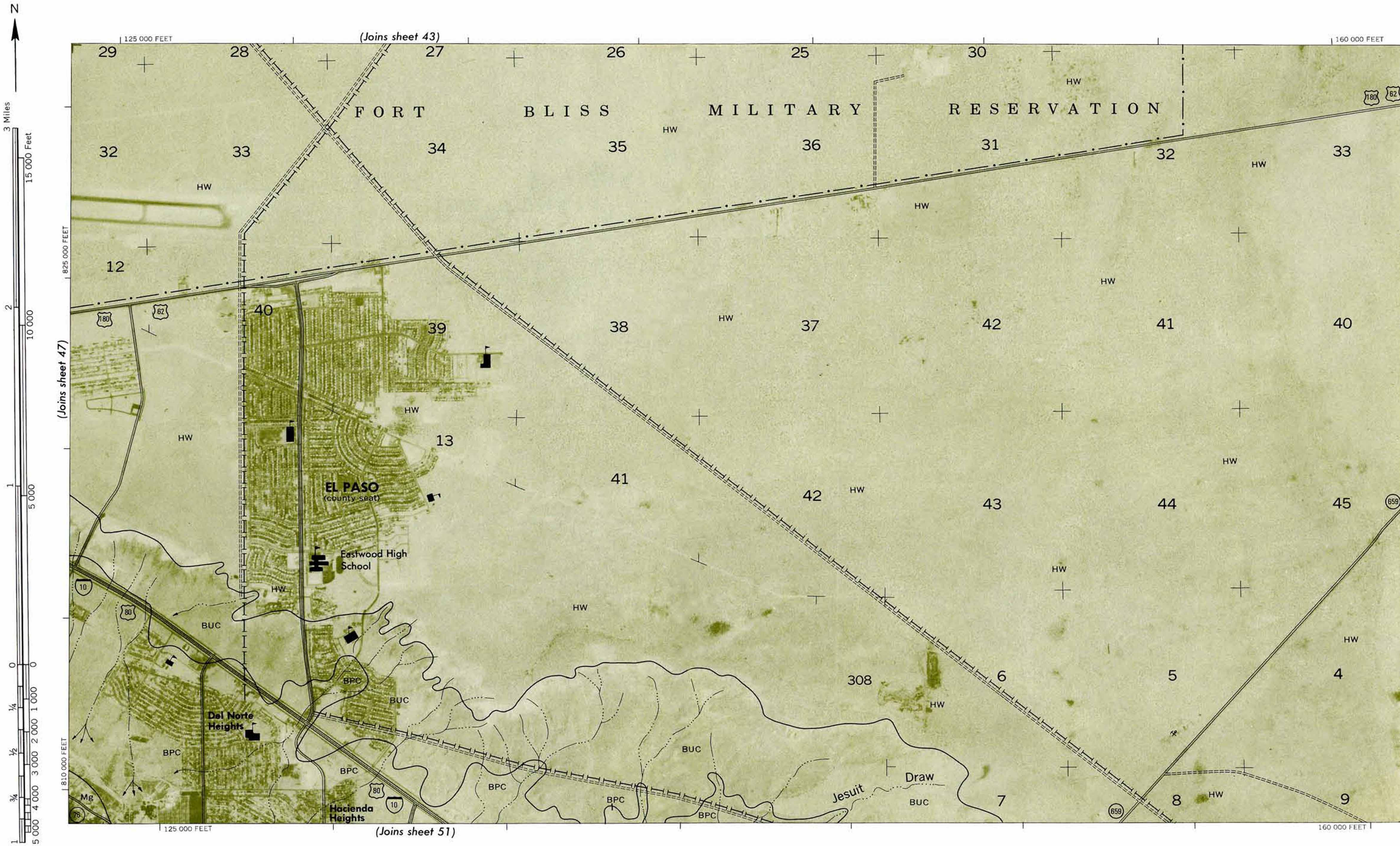
47

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

EL PASO COUNTY, TEXAS NO. 47


Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

# EL PASO COUNTY, TEXAS — SHEET NUMBER 48



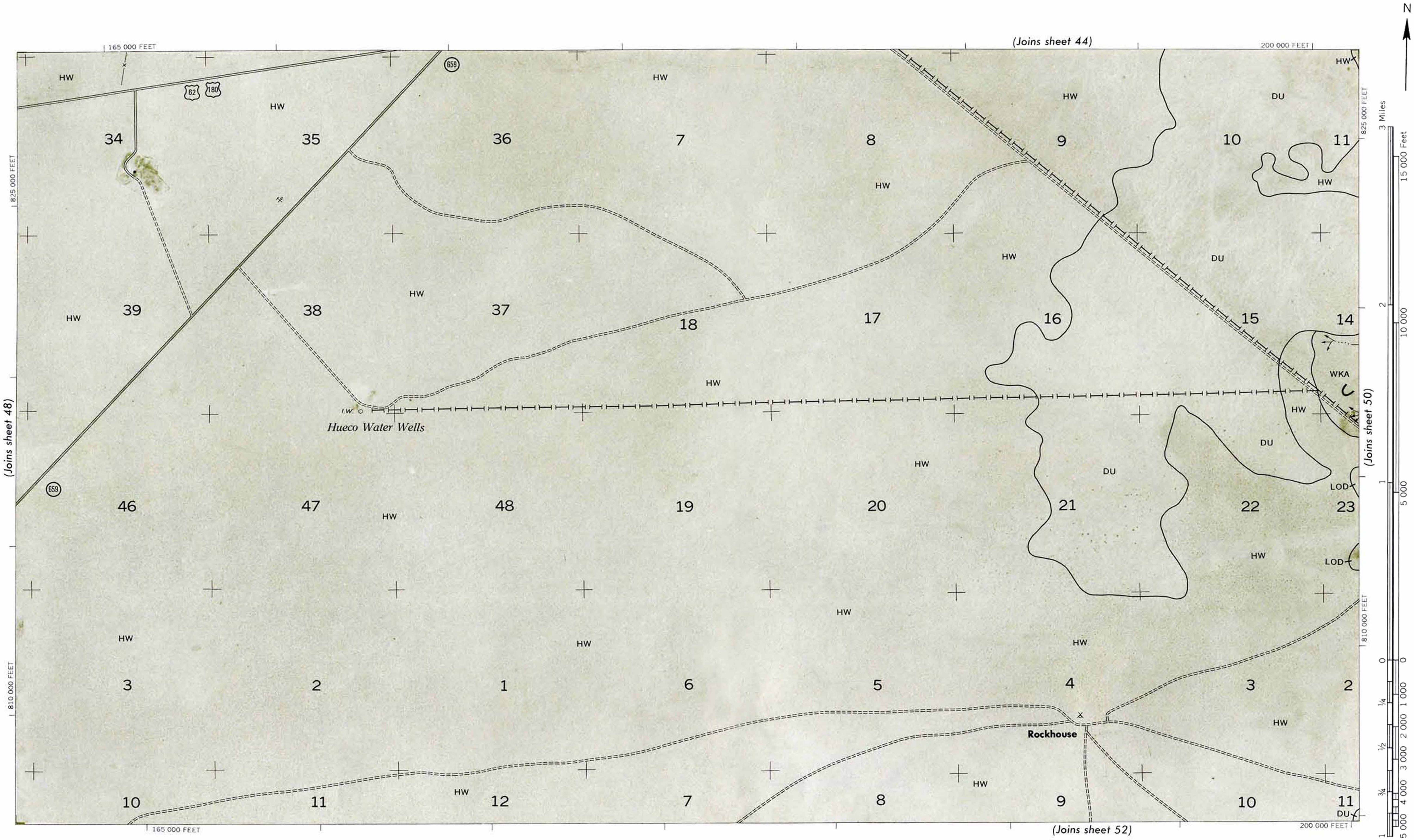

EL PASO COUNTY, TEXAS NO. 48

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

49




This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Land division corners are approximately positioned on this map.

EL PASO COUNTY, TEXAS NO. 49

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

EL PASO COUNTY, TEXAS — SHEET NUMBER 50

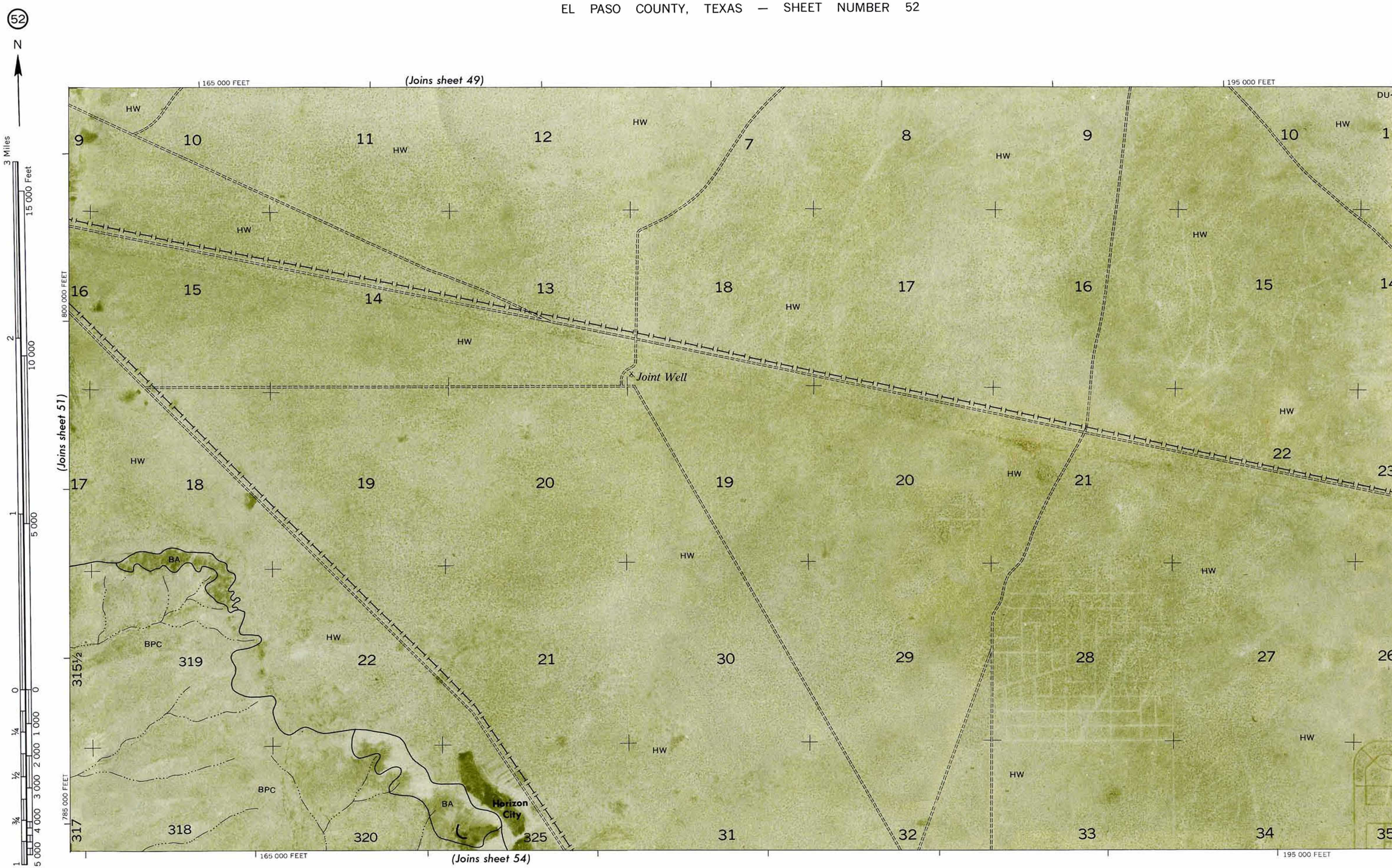

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

EL PASO COUNTY, TEXAS NO. 51


Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

EL PASO COUNTY, TEXAS — SHEET NUMBER 52

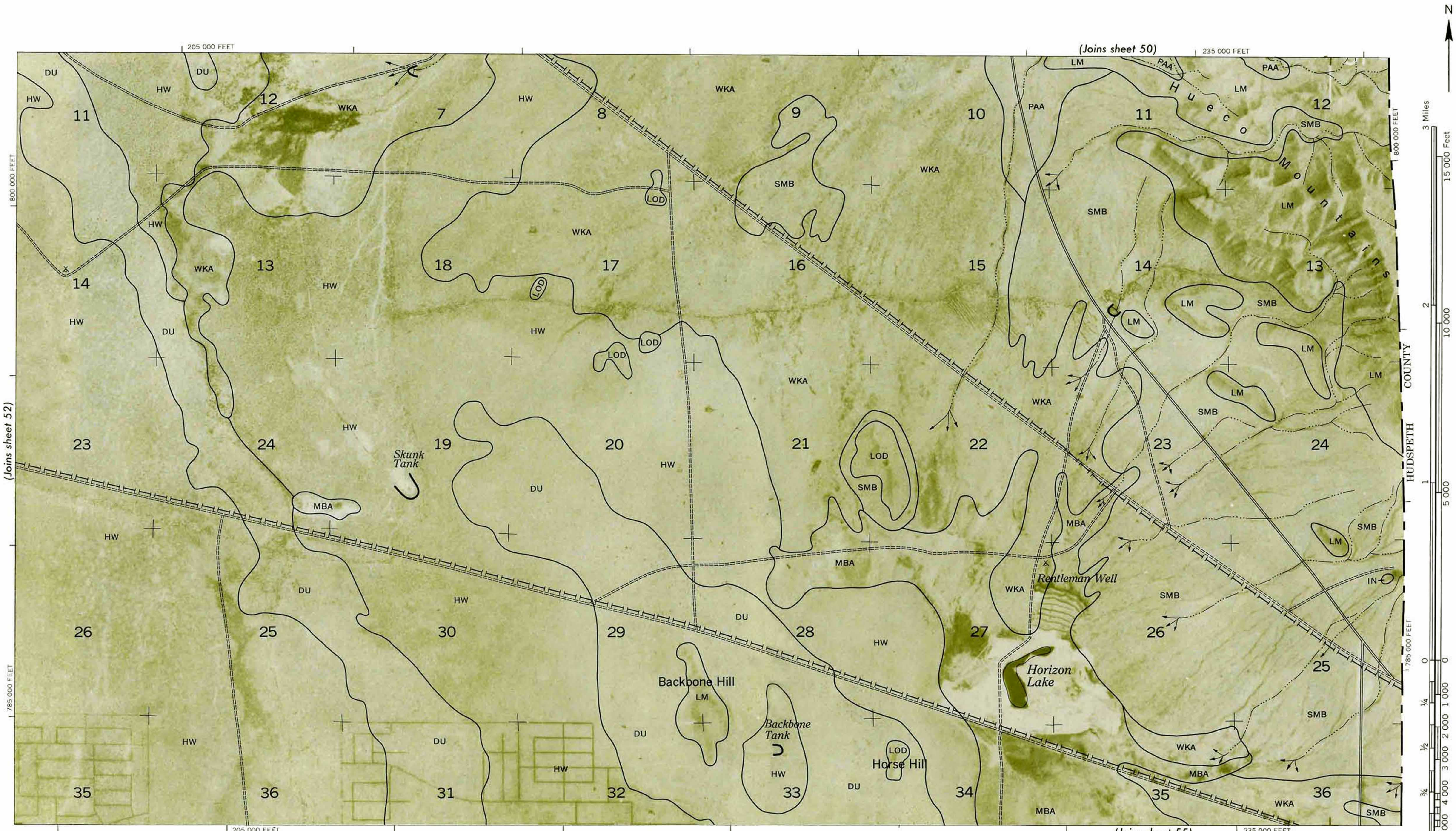



EL PASO COUNTY, TEXAS NO. 52

Land division corners are approximately positioned on this map.

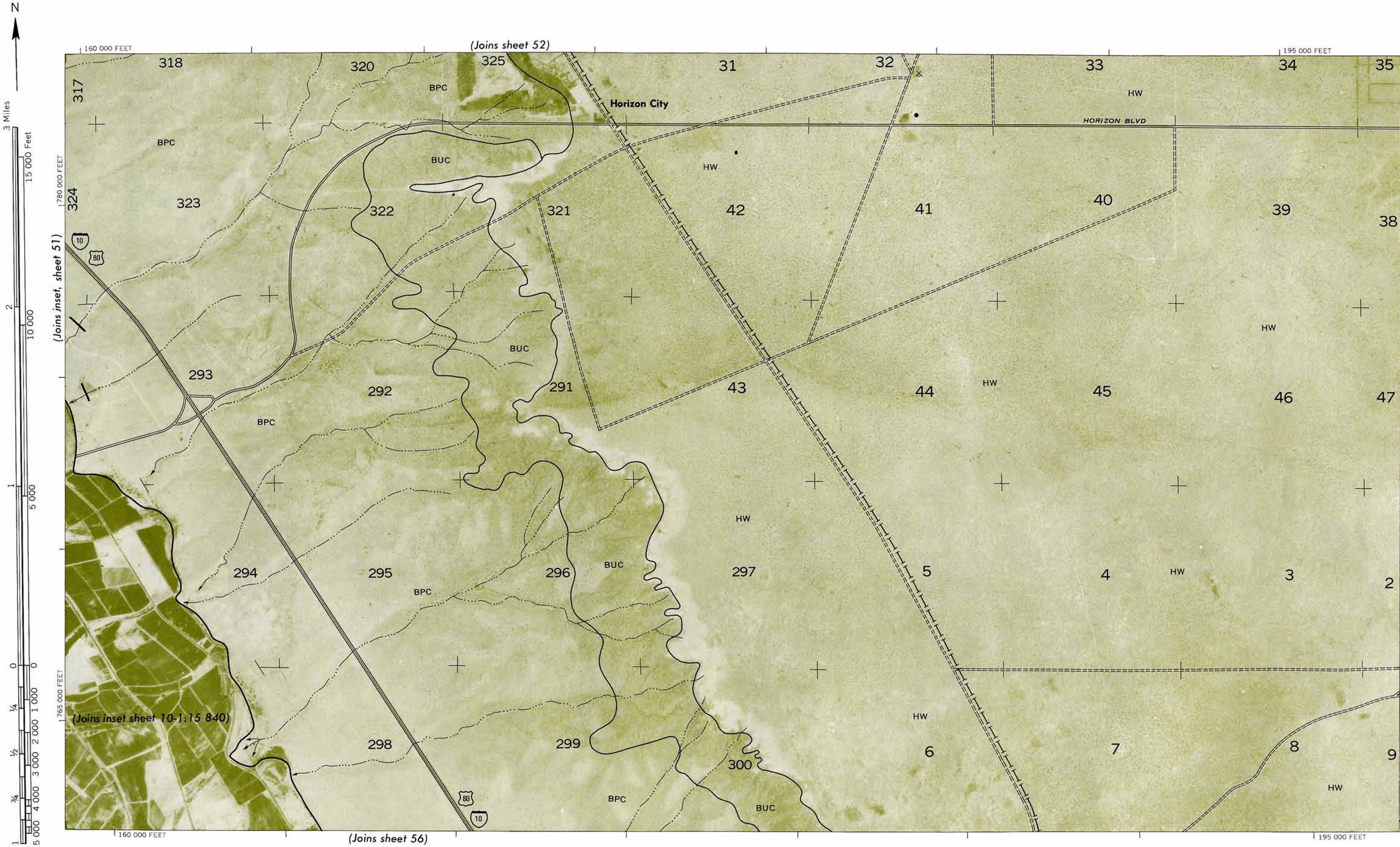
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.






Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.



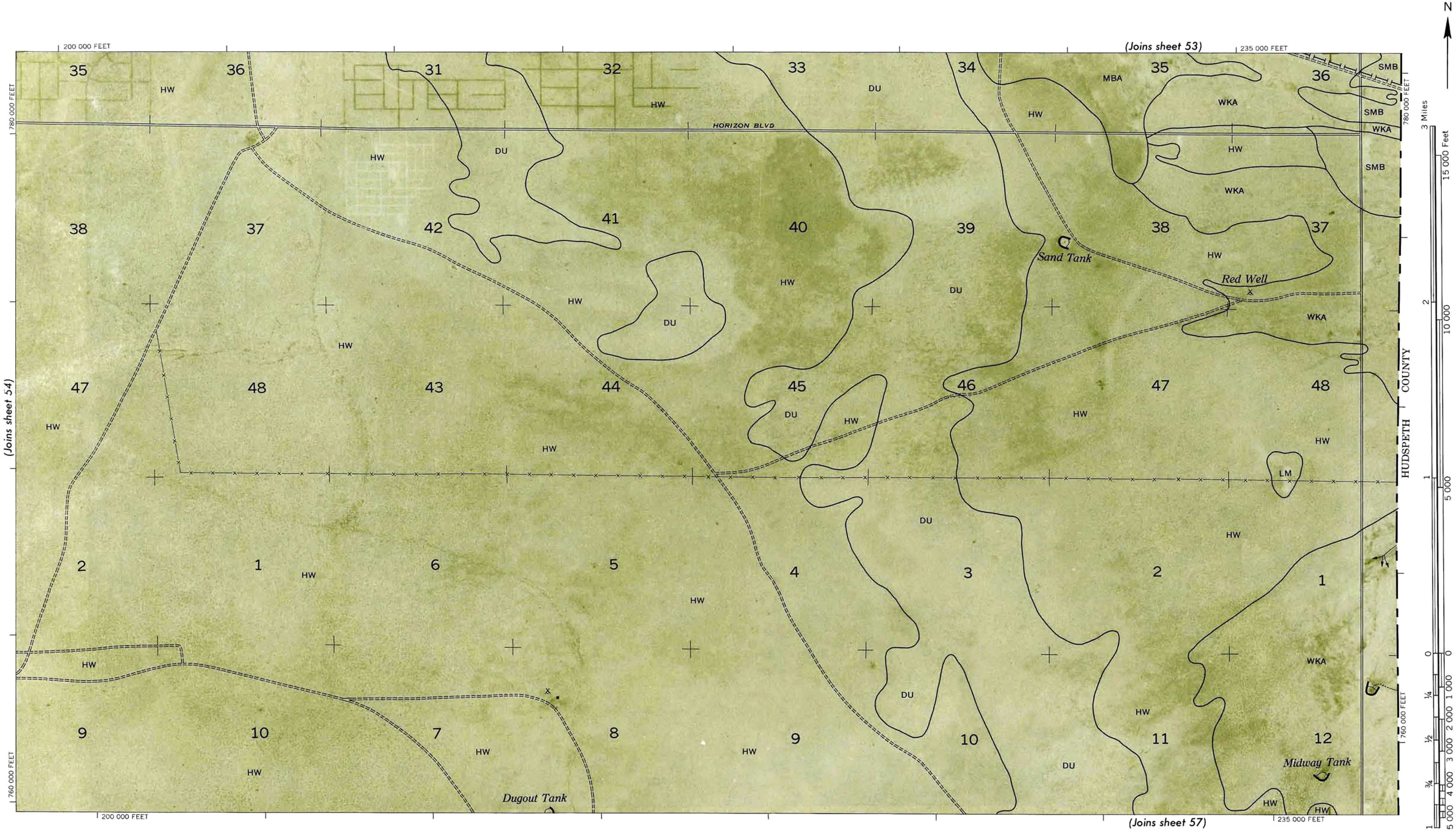

EL PASO COUNTY, TEXAS NO. 54

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

EL PASO COUNTY, TEXAS — SHEET NUMBER 55




EL PASO COUNTY, TEXAS NO. 55

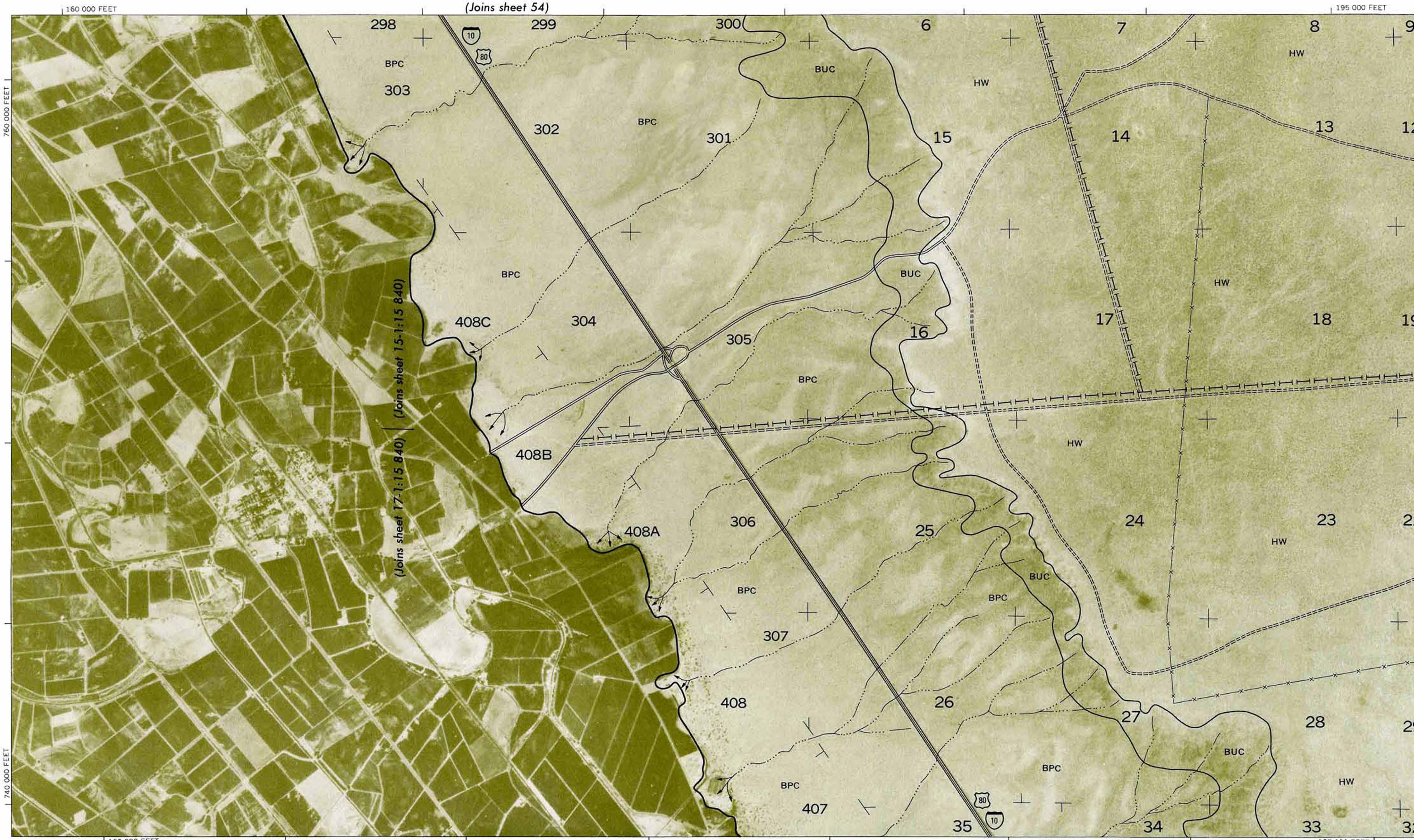
Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

EL PASO COUNTY, TEXAS — SHEET NUMBER 56

N

3 Miles
2
1
0
¼
½
¾
1

15 000 Feet
10 000
5 000
0
1 000
2 000
3 000
4 000
5 000

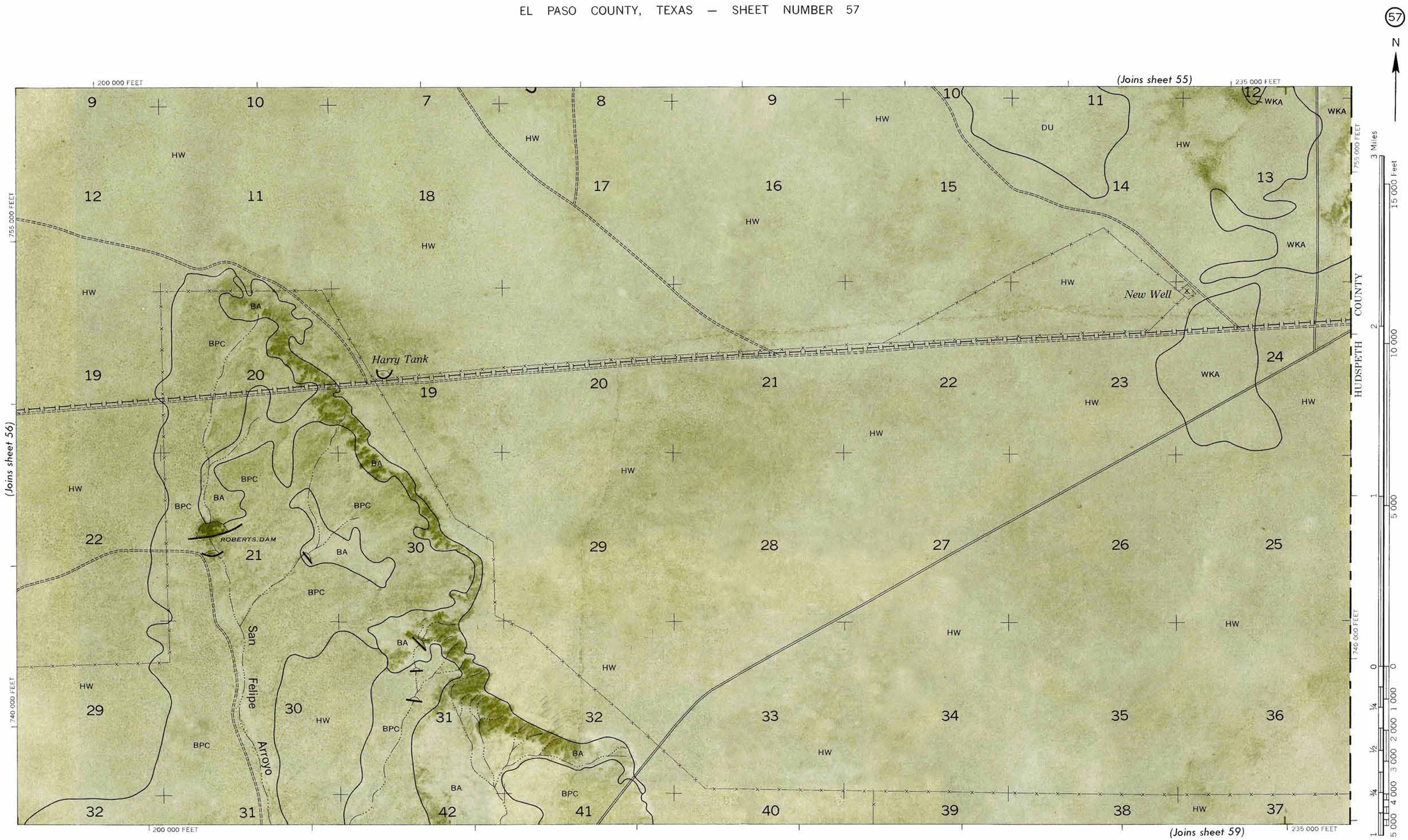



EL PASO COUNTY, TEXAS NO. 56

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum

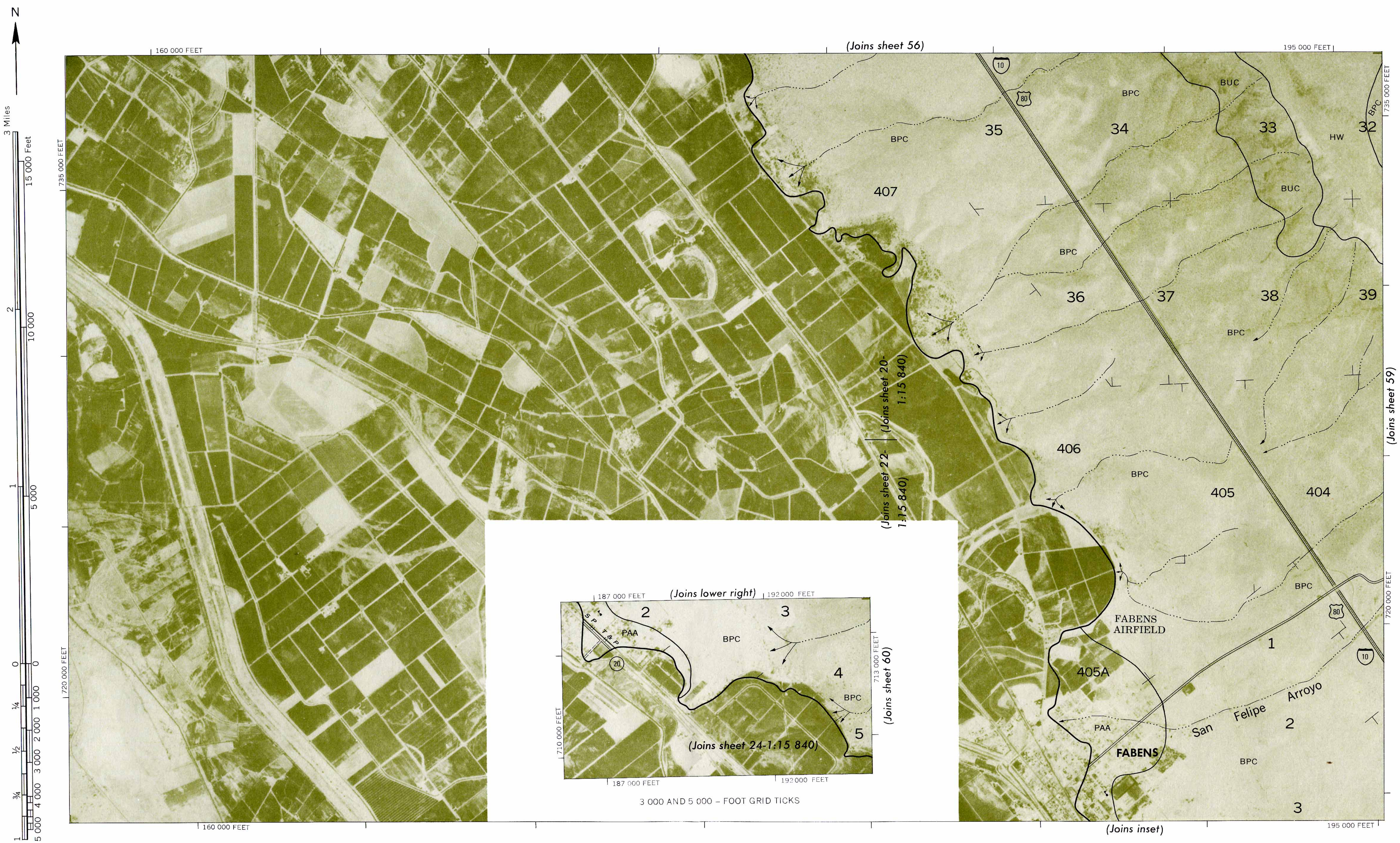



EL PASO COUNTY, TEXAS NO. 57

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

EL PASO COUNTY, TEXAS — SHEET NUMBER 58




Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

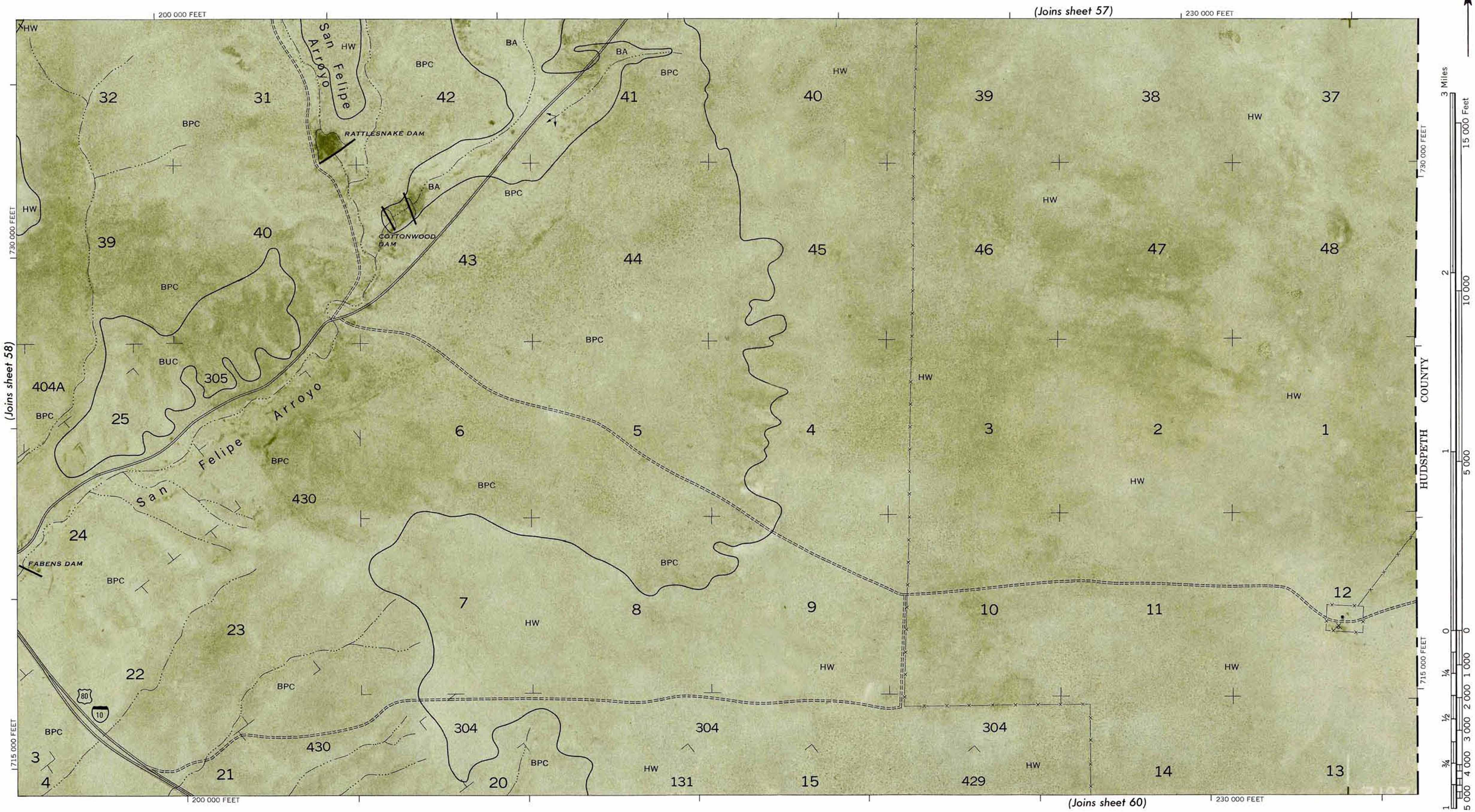
EL PASO COUNTY, TEXAS NO. 58

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

EL PASO COUNTY, TEXAS — SHEET NUMBER 59

59

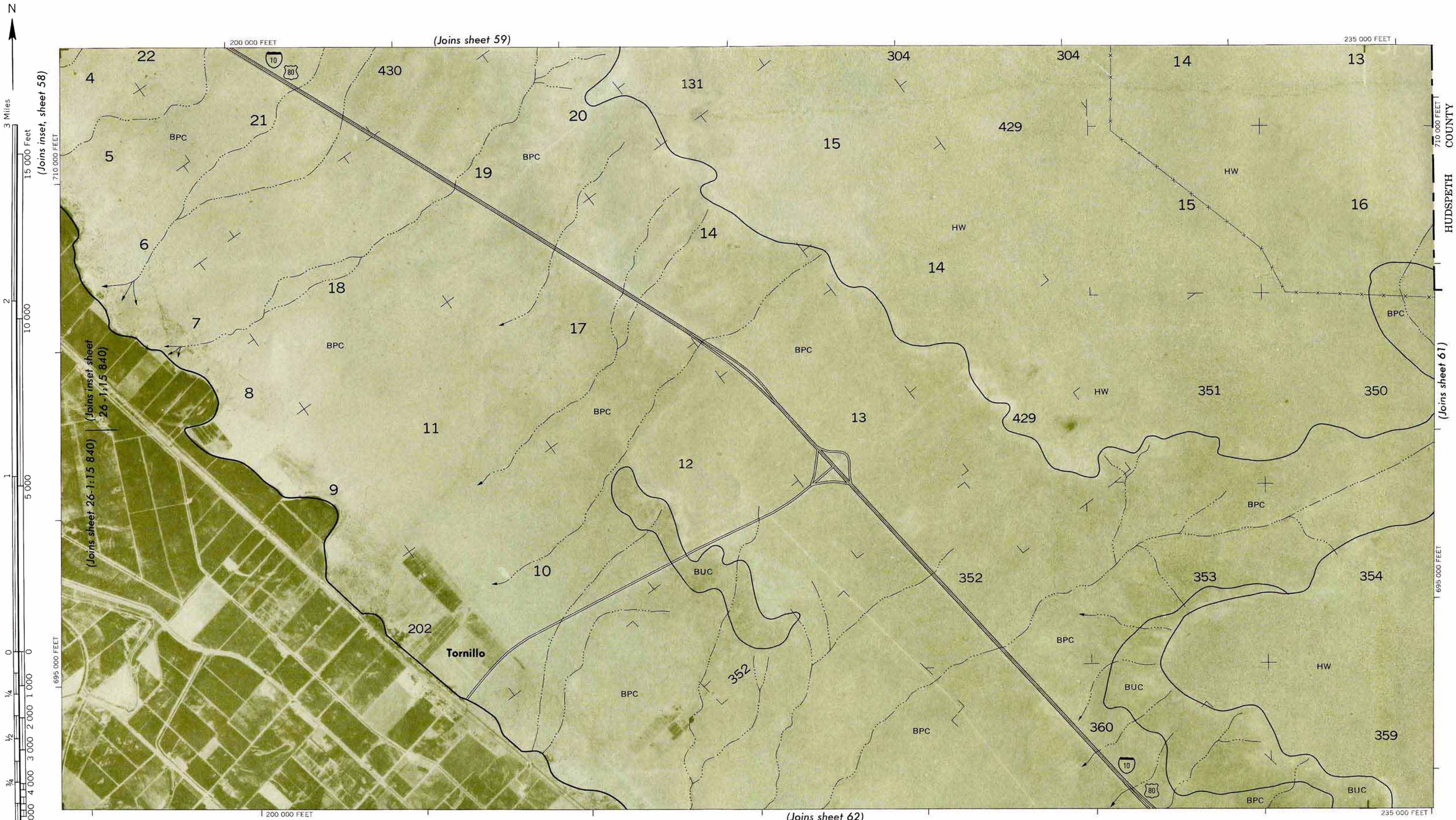



EL PASO COUNTY, TEXAS NO. 59

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

# EL PASO COUNTY, TEXAS — SHEET NUMBER 60




EL PASO COUNTY, TEXAS NO. 60

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Land division corners are approximately positioned on this map.

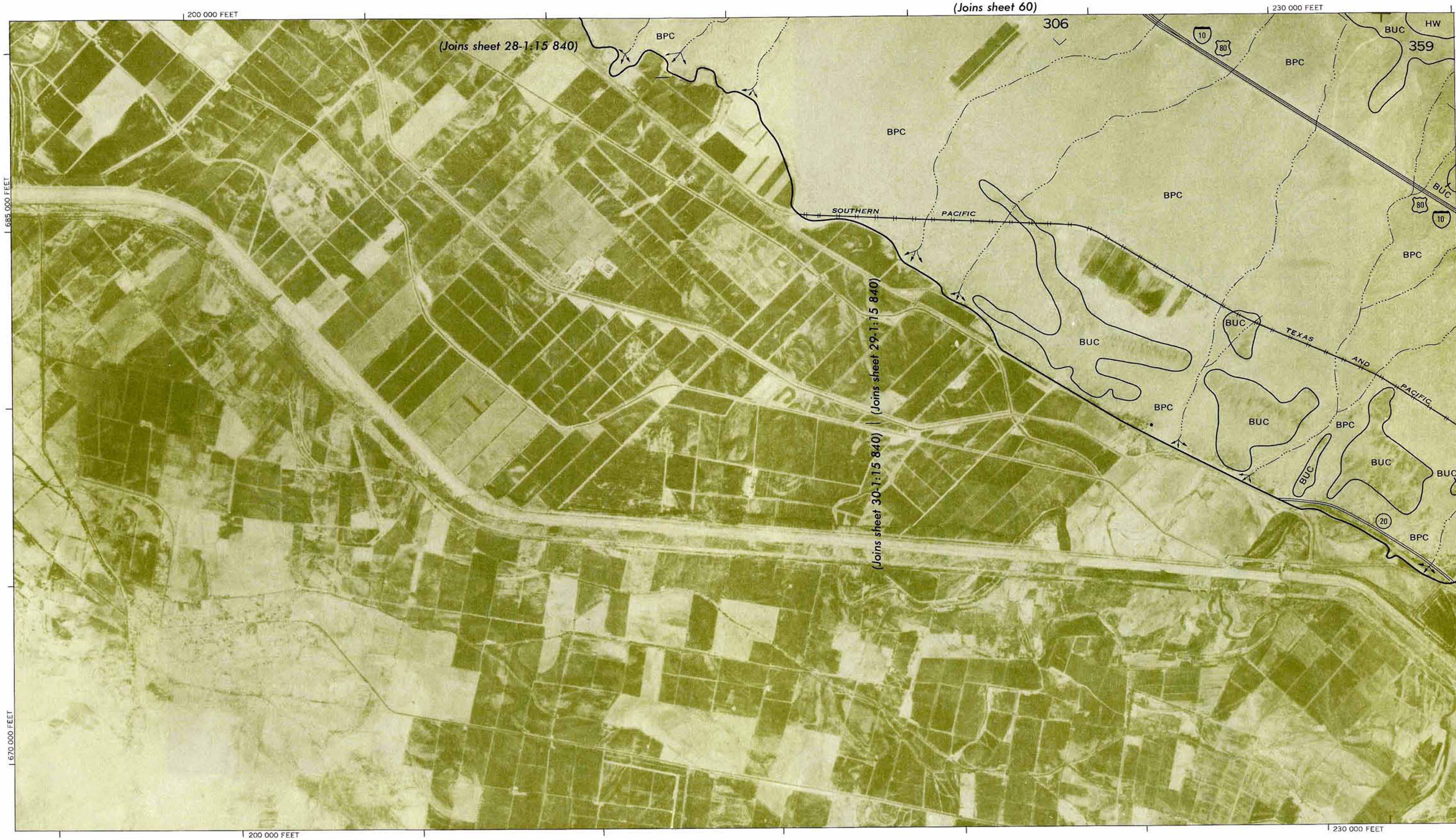
EL PASO COUNTY, TEXAS NO. 61


Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.

62

N

3 Miles
15 000 Feet
2
10 000
1
5 000
0 0
¼ 1 000
½ 2 000
3 000
¾ 4 000
1 5 000




EL PASO COUNTY, TEXAS NO. 62

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1960 and 1964 aerial photographs. 5,000-foot grid ticks based on Texas plane coordinate system, central zone. 1927 North American datum.